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The Rontgen Oration.¹

RADIATION HAZARDS OF ATOMIC ENERGY.

By MARCUS OLIPHANT,
Canberra.

Introduction.

THE closing years of the last century were some of the most remarkable in the history of the physical sciences. Röntgen discovered X rays, which have provided physics with one of the most powerful tools for the unravelling of atomic and molecular structure; J. J. Thomson tied together the observations made by several investigators and from his own inspired experiments discovered the electron, thereby showing that the atoms themselves were composite structures; Becquerel discovered the phenomenon of radioactivity and set the Curies on the track of radium; theoretical physics had reached the stage where, from the further development of the electromagnetic theory of Maxwell and the kinetic theory of gases, the new experimental discoveries stimulated the rapid advance which led to the ideas of relativity, the quantum theory and modern ideas of atomic structure. From the point of view of the subsequent development of nuclear physics, perhaps the most important event of all was that a young New Zealander, Ernest Rutherford, went to Cambridge in 1895 to work with J. J. Thomson, whereby his genius was guided into the realms of radioactivity and the structure of atoms. He made these subjects his own and with his colleagues and research students in Montreal, Manchester and Cambridge made almost every important discovery

which led, after his death, to the release of atomic energy. Fortunately, his great devotion to science and the acquisition of new knowledge was not shaken, as is that of his successors, by the irresponsible misuse of that knowledge, which threatens a world which has so much to gain from the proper use of science. Among the more serious long-term hazards of the irresponsible use of atomic energy are the biological effects of γ and particle radiations, which are emitted in great quantities in the nuclear processes involved.

The Structure of Atoms.

The picture of an atom which is in accord with existing knowledge is that proposed originally by Rutherford and put into quantitative mathematical form by Bohr. This Rutherford-Bohr model envisages a central core or nucleus to the atom, surrounded by planetary electrons occupying orbits, or energy levels, which are in accord with the principles of quantum mechanics. The positive electric charge on the nucleus is neutralized by the equal negative charge on the electrons, and it is the attraction between these opposite charges which holds the structure together. The diameter of an atom is about one hundred-millionth of an inch. That of the nucleus is about ten thousand times smaller, so that one million million nuclei must be placed side by side to measure one inch. Transitions of electrons between the outermost energy levels of an atom give rise to the emission of ordinary light, while transitions involving the inner electronic levels of the heavier atoms give rise to X rays.

Ordinary chemical binding of atoms, such as occurs when carbon combines with oxygen in the burning of coal, arises from the interaction of the outermost electrons of the combining atoms. Although we use such chemical processes as our primary source of power, the energy released when atoms combine to form compounds is not large. In considering atomic processes it is convenient to use as the

¹ Delivered at a meeting of the College of Radiologists (Aust. and N.Z.) on November 10, 1951, at Canberra.

unit of energy that energy which would be gained by an electron when it fell through a potential difference of one volt, the so-called electron-volt. (You are familiar with this term in radiology, for when you speak of, say, 60,000 volt X rays you mean X rays the energy of a quantum of which is 60,000 electron-volts.) In these units the energy set free in chemical processes, such as the burning of carbon, is of the order of a few electron-volts only. Complex molecules, such as proteins or hydrocarbons, may have binding energies far less than this, so that such substances can be disrupted by absorption of energies of a fraction of an electron-volt. The chemical processes taking place in living matter proceed by stages involving very small energy changes and so can be interfered with by simple external influences, such as moderate degrees of heat or cold.

The Structure of the Nucleus.

The charge on the nucleus of an atom determines how many electrons are grouped around it and how these electrons are arranged. In other words, it determines the chemical species of the atom and all its ordinary chemical properties. The positive nuclear charge increases step by step with position in the periodic table of the chemical elements, being 1 for hydrogen, 2 for helium and so on up to 92 for uranium, the heaviest chemical substance known in the earth's crust. This charge is thus identified with atomic number.

It was tempting to assume that the nuclei of all chemical elements were built up from hydrogen nuclei, and Rutherford accordingly named these elementary particles protons. However, the nuclei of heavier atoms do not possess masses equal to their charges in terms of the proton. Thus ordinary helium has a mass four times that of hydrogen but a charge of 2. Hence it was necessary to assume that some of the charges on the protons were neutralized by equal negative (electronic) charges in the nucleus. This idea, that electrons exist in the nucleus, was supported by the fact that electrons are emitted, as β particles, in some radioactive transformations. However, it soon became evident that such a structure was not possible, since the electron is too large to fit inside the nucleus. In 1921, in order to evade some of the difficulties of fitting electrons into the nucleus, Rutherford speculated whether there might not exist a particle which he called a neutron, with the same mass as a proton but without electric charge. Although he searched for such a particle at the time, the techniques of observation were not good enough. In 1932 Chadwick, who was Rutherford's assistant in Cambridge, was able to demonstrate the existence of the neutron by using the new electronic methods.

It now became possible to form a picture of the nucleus as composed of protons and neutrons, so that, for instance, a helium nucleus contained two protons (charge 2) and two neutrons, and a uranium 238 nucleus consisted of 92 protons with 146 neutrons. The exact nature of the forces which hold together the particles in a nucleus is not known and presents one of the most fascinating problems of modern nuclear physics. We know only that the binding energies arising from these forces are very large indeed compared with chemical binding energies, amounting, for each proton or neutron, to about 8,000,000 electron-volts.

The very large binding energy of nuclei can be visualized by remembering that if we could take one pound of hydrogen and transform it into a little less than one pound of helium, the energy set free would amount to 100,000,000 kilowatt hours, or the total energy released by burning about 12,000 tons of good coal!

Nuclear Transformations.

Since the nucleus is bound together by forces of enormous magnitude, any rearrangement of the structure involves the absorption or emission of large energies. Hence ordinary physical forces have no influence whatever on the nuclei of atoms. It is impracticable to affect them by heat or cold, by pressure, by state of chemical combination or by electric or magnetic fields.

Certain nuclei which exist in nature are inherently unstable and spontaneously assume a more stable configuration by emitting charged particles and radiation. The phenomenon of radioactivity was recognized first among the heaviest elements, and you are all familiar with the way in which uranium is transformed, by emission of α particles (helium nuclei of mass 4 and positive charge 2), β particles (electrons carrying a negative charge of 1 and very small mass) and γ rays (X rays of high frequency), into a stable form of lead. Each step in the transformation involves the release of energy of the order of magnitude of several million electron-volts, those of highest energy being associated with very small life-times. It is now known that radioactive elements of relatively low atomic number also exist in nature; for example, the potassium nucleus of mass 40 is radioactive, emitting β particles of rather low energy, rubidium possesses a radioactive isotope, samarium is α -active.

The spontaneous transformation of an unstable nucleus is governed by the laws of probability. Thus a given mass of radium would disintegrate only in an infinite time, but the time required for a given fraction, say half, to transform, is definite and is called the half-life of the radioactive species. These half-lives vary from periods of the order of a million million years for substances like uranium or potassium, to a millionth of a second or less for species like radium C'. Before the recent development in techniques the very short-lived substances were recognized only because they were steps in a radioactive series, like those of uranium or thorium. Radioactive nuclei existing in the earth's crust were primarily formed in the original cataclysm of the birth of the galaxy and represent the long-lived surviving species of a far more general population of radioactive substances, most of which have decayed completely away in the early history of the earth. Many of these other radioactive elements can now be made artificially in the laboratory and possess the expected short lives.

In the radio-active process of emission of α particles two protons and two neutrons are emitted from within the nucleus combined together as a helium nucleus. The α particles are emitted with definite discrete energies. The emission of a β particle (electron) is a more complex process, involving the transformation of a neutron into a proton and electron and escape of the electron born near the surface of the nucleus. The electrons emerge with a wide spectrum of energies from zero to a clearly defined maximum. Since the product nucleus of a β transformation has definite total energy, it is assumed that some energy in the transformation is carried away by a second emitted particle carrying no electric charge and with a vanishingly small mass. This mysterious particle, whose properties render it impossible to detect directly, has been called a neutrino. Although physicists speak very glibly of neutrinos, these particles are little more than a cloak for ignorance, being assumed to exist because of a natural reluctance to abandon, in these special cases only, the universal laws of conservation of mass-energy and momentum. For the purposes of this lecture we can neglect them.

Nuclei which have emitted a charged particle may be left in an excited state with excess energy, which is then emitted as one or more γ rays (electromagnetic radiation similar to X rays).

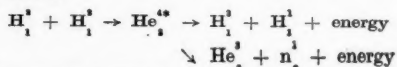
There are rarer modes of radioactive transformation involving the spontaneous emission of positively charged electrons (positrons) or neutrons, or interaction between an excited nucleus and the external electrons. The details of these processes are important in physics, but not for the purposes of this lecture.

Nuclei may be transformed artificially by introducing into them extra protons or neutrons or by absorption of γ rays of sufficient energy. Rutherford discovered that charged particles like helium nuclei (α particles) could be fired into the interior of nuclei, provided they possessed great enough kinetic energy to penetrate through the repulsive electric field surrounding the charged nucleus. Cockcroft and Walton, working with Rutherford, showed that such atomic projectiles could be produced by electrical

methods, and the inventive scientists soon produced a rash of cyclotrons, high-voltage generators, betatrons, and other devices to provide these particles. After the discovery of the neutron it was found that since these particles possessed no electric charge, they could enter nuclei with great ease, even at the lowest possible kinetic energies, and produce transformations.

When a particle is captured by a nucleus it carries with it, in addition to its own kinetic energy of motion relative to the struck nucleus, the binding energy of about 8,000,000 electron-volts. Hence a nucleus which has absorbed a particle, even a neutron with very low kinetic energy, is in a highly excited state and gets rid of this excess energy by emitting γ rays, charged particles, neutrons, or a mixture of these products. Some examples will illustrate what happens.

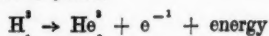
Heavy hydrogen (deuterium), when bombarded by deuterium nuclei, undergoes two alternative transformations. In the shorthand symbolism of nuclear physics these can be written:



Here the symbol "H" indicates that the nucleus is of hydrogen, "He" that it is helium, "n" that it is a neutron, an asterisk that the nucleus is highly excited; the upper number indicates the mass, the lower the charge of each species. Thus the upper equation indicates that the products of transformation of the excited nucleus, formed by the capture of a nucleus of deuterium by deuterium, may be hydrogen of mass 3, hydrogen of mass 1 (proton) and energy, while the lower equation shows that alternatively the products may be helium of mass 3, a neutron and energy. The energies in each case appear as kinetic energies of the products, distributed between them according to the momentum laws. The neutrons from the second reaction have an energy of about 2,000,000 electron-volts, and the process constitutes a very convenient source of neutrons of known energy. The equations also show the detailed conservation of mass-energy, the masses on the two sides of each equation balancing exactly if the

equivalent mass, $m = \frac{\text{energy}}{c^2}$, where c is the velocity of light, is substituted for the observed energy release.

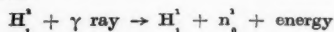
The hydrogen nucleus of mass 3, formed in the first reaction, is unstable and is transformed by radioactive emission of a β particle into helium of mass 3, with a half-life of about eleven years.



In this equation again the masses and energies balance if we include the energy of the hypothetical neutrino.

These are typical nuclear reactions produced by charged particles and giving energetic charged particles and neutrons. In the case of heavier elements one of the product nuclei may be left in an excited state and emit an energetic γ ray.

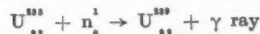
If γ rays of energy greater than about 2,000,000 electron-volts fall upon deuterium nuclei, they are absorbed, the highly excited nucleus so produced splitting into a proton and a neutron:



About 2,000,000 electron-volts of the energy of the γ rays are used to overcome the binding forces between the proton and neutron in the deuterium nucleus, the remainder appearing as kinetic energy of the particles. Such photo-disintegration of most nuclei can be produced by absorption of sufficiently energetic γ rays, "chipping-off" protons, neutrons, and in some cases α particles.

A series of important transformations take place when neutrons are absorbed by the heavy elements, thorium and uranium. Uranium contains two principal isotopes, or nuclei with the same charge (atomic number) but different masses, U^{238} and U^{235} . These behave differently when they

capture neutrons of moderate energy. After neutron capture by U^{238} a γ ray is emitted and a highly radioactive isotope of uranium of mass 239 is produced:



The U^{239} emits a β particle (negative electron), thus gaining a positive charge and being transformed into a new chemical substance of atomic number 93, which has been called neptunium:



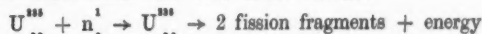
The neptunium so produced is itself radioactive and emits a further electron to become an element of atomic number 94, called plutonium:



These two β processes have life-times of some minutes, so that when U^{238} is bombarded with neutrons of moderate energy there is a steady accumulation of plutonium. Plutonium itself is radioactive, emitting α particles and being transformed to U^{238} , but its half-life is some tens of thousands of years, so that it is a semi-permanent atomic species like radium.

The Fission Process.

The isotope of uranium of mass 235 can absorb a neutron of any energy. The resultant complex nucleus of mass 236 is highly unstable and, instead of settling down to a stable or semi-stable state by emitting γ rays or charged particles, it splits approximately into halves, the two fission fragments separating with very great energy:



The energy release in the process is about 200,000,000 electron-volts. The masses of the fission fragments, which are nuclei of atomic species near the middle of the periodic table, are distributed over a wide range, the most probable ratio of the masses of the two particles being 2:3. The fission fragments are not stable nuclei but are β -active, since they contain too many neutrons and so emit several electrons and γ rays before being transformed into stable species. In fact, the fission fragments are so highly unstable that some of them emit neutrons with energies up to a few million electron-volts. A fraction of these neutrons may be emitted after a period up to two seconds or more.

Plutonium undergoes fission on absorption of a neutron in much the same way as U^{235} .

The Chain Process.

Since the fission of U^{235} or Pu^{239} is produced by absorption of neutrons, while the fission process itself results in the production of one to three neutrons, it is clear that absorption of these neutrons in further U^{235} or Pu could produce one to three fresh fissions, each of those several further fissions and so on, the number of atoms undergoing fission at any moment increasing rapidly with time. Such a chain process becomes possible if the mass of fissionable material is larger than a certain critical size, where sufficient fresh fissions are produced inside to compensate for loss of neutrons into the surrounding space. For pure U^{235} or pure Pu^{239} this critical size is quite small, corresponding for a spherical shape with a mass between one and one hundred kilograms. A piece of fissionable material smaller than the critical size is quite stable. Owing to the continuous spontaneous production of small numbers of neutrons inside the mass, a piece of such material which is greater than the critical size is bound to develop a chain process, with the very rapid evolution of enormous quantities of energy. This is the atomic bomb.

By diluting the fissionable material with a substance which does not capture neutrons readily, the time between a fission and subsequent absorption of the fission neutrons, which wander round and lose energy in the "moderator" before colliding with fresh fissionable atoms, can be made relatively long. The chain process then builds up slowly, and if the system is only a little above the critical size, the

unit of energy that energy which would be gained by an electron when it fell through a potential difference of one volt, the so-called electron-volt. (You are familiar with this term in radiology, for when you speak of, say, 60,000 volt X rays you mean X rays the energy of a quantum of which is 60,000 electron-volts.) In these units the energy set free in chemical processes, such as the burning of carbon, is of the order of a few electron-volts only. Complex molecules, such as proteins or hydrocarbons, may have binding energies far less than this, so that such substances can be disrupted by absorption of energies of a fraction of an electron-volt. The chemical processes taking place in living matter proceed by stages involving very small energy changes and so can be interfered with by simple external influences, such as moderate degrees of heat or cold.

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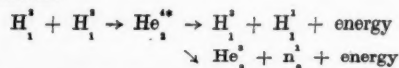
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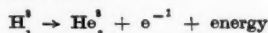
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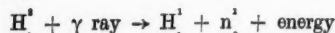
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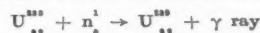
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Plutonium undergoes fission on absorption of a neutron in much the same way as U^{235} .

The Chain Process.

Since the fission of U^{235} or Pu^{239} is produced by absorption of neutrons, while the fission process itself results in the production of one to three neutrons, it is clear that absorption of these neutrons in further U^{235} or Pu could produce one to three fresh fissions, each of those several further fissions and so on, the number of atoms undergoing fission at any moment increasing rapidly with time. Such a chain process becomes possible if the mass of fissionable material is larger than a certain critical size, where sufficient fresh fissions are produced inside to compensate for loss of neutrons into the surrounding space. For pure U^{235} or pure Pu^{239} this critical size is quite small, corresponding for a spherical shape with a mass between one and one hundred kilograms. A piece of fissionable material smaller than the critical size is quite stable. Owing to the continuous spontaneous production of small numbers of neutrons inside the mass, a piece of such material which is greater than the critical size is bound to develop a chain process, with the very rapid evolution of enormous quantities of energy. This is the atomic bomb.

By diluting the fissionable material with a substance which does not capture neutrons readily, the time between a fission and subsequent absorption of the fission neutrons, which wander round and lose energy in the "moderator" before colliding with fresh fissionable atoms, can be made relatively long. The chain process then builds up slowly, and if the system is only a little above the critical size, the

fact that the emission of some fission neutrons is delayed further increases the time required for the chain process to reach a given intensity. Some of the neutrons wandering about in the moderator can be absorbed and removed from the system by inserting into the interior rods of substances like boron, which have a large capacity for absorbing slow neutrons. In this way growth of the chain process can be checked, and by adjusting the position of the rods the energy liberated can be kept at any desired level. The energy appears ultimately as heat in the uranium rods and can be removed by cooling the rods with water, molten metal or circulating gas. To protect the uranium from corrosion, and to prevent the escape of radioactive fission-products into the coolant, coatings of aluminium, or other material which does not absorb neutrons appreciably, are applied over the uranium. To prevent escape of neutrons and harmful radiations from the outer surface of the system, the whole is enclosed within a thick shield of steel and concrete.

Such an arrangement is a slow-neutron reactor, or "pile", and is the system most likely to be used, initially, for development of atomic energy for industrial purposes. If ordinary uranium containing U^{235} as well as U^{238} is used in the reactor, some of the neutrons are absorbed by the U^{238} to produce plutonium. This plutonium can be separated from the uranium rods by chemical methods after exposure in the reactor for an optimum time.

Radiation Hazards.

We are now in a position to discuss in very general terms the nature of the radiation hazards which arise in work in nuclear physics and atomic energy. The biologically important radiations encountered are: electromagnetic radiation as γ rays; neutrons; charged particles—electrons, α particles, protons *et cetera*. The first and third of these are precisely the same, except for energy and intensity, as the radiations experienced in the therapeutic use of X rays and radium. The precautions necessary to avoid harmful effects are precisely the same as those familiar to all workers in these fields, though the penetrations and intensities met with are relatively enormous. Thus an atomic energy reactor producing 1000 megawatts of heat energy would contain radioactive fission products equivalent to over 100 tons of radium, while a modern synchrotron accelerator will produce protons with an energy of 1,000,000,000 electron-volts, capable of penetrating several feet of steel or concrete.

The neutrons emitted in many nuclear reactions and from nuclear reactors are capable of penetrating considerable thicknesses of matter. Their biological effects are due to the elastic recoil of atomic nuclei, particularly protons, struck by fast neutrons, and to the production of radioactive substances by the capture of slow neutrons in the nuclei of atoms in the tissues and in the bones. Owing to the high intensity of ionization produced along the tracks of recoil nuclei, which behave very much like α particles, and to the residual radioactivity, the biological effects of neutrons have not been completely evaluated, so that the tendency is to play safe and adopt extreme precautions against irradiation.

It will be convenient to discuss these hazards in relation to some specific examples of production of radiation. At the present time the greatest threat to mankind arises from the possible use of atomic weapons in a looming world war, though from the point of view of the future of humanity other applications of atomic energy may be more important in the long run.

The explosion of an atomic bomb is most effective in destroying buildings and life over a wide area if it takes place 1000 to 2000 feet above the ground. The actual detonation is over in a few millionths of a second, during which a very intense stream of neutrons and of electromagnetic radiation of wave-length from heat to γ rays is emitted in all directions. The resultant fission products in the characteristic "ball of fire" emit such radiations for about one minute. The intensity of this radiation falls off with distance according to the inverse square law and owing to absorption in the air. For an "ordinary" atomic bomb

radiation effects fall off in the following way with distance from the point immediately beneath the air explosion ("ground-zero"). Within a circle of about a half-mile radius unprotected persons would experience fatal burns due to the intense thermal radiation. The intensity of γ rays and neutrons over this area is such that everyone not protected by a considerable thickness of absorbing material such as earth, metal or concrete, would succumb within a few hours to as much as six weeks after exposure. However, most people in this area would be killed by blast in any case. In the area from half to one mile in radius second and third degree flash burns would be accompanied by fatal and non-fatal injury by ionizing radiation. Flash burns and radiation injury would be serious up to about one and a quarter miles from ground-zero. Some cases of flash burns and radiation sickness occurred in Hiroshima and Nagasaki at distances up to two miles from ground-zero, but within this area the effects fall off very rapidly. An air-burst produces very little residual activity even at ground-zero. The highly radioactive products of the explosion are carried up by the rising columns of heated air to a height of 30,000 to 60,000 feet and are diluted and dissipated by winds. Some radioactive dust will be precipitated, but over such a wide area that no biological effects can be expected. If, by chance, rain should fall through the ascending radioactive cloud, dangerous activities might be carried down and deposited on the ground or buildings.

A burst on the ground or near the ground could result in much dust being carried up with the ascending column, and although the subsequent deposition of this contaminated material would give increased radioactive effects on the ground, it is improbable, except in freak weather conditions, that these would be serious.

An underwater burst does not cause widespread destruction by blast, burns or direct action of radiation, because of the absorbing effect of the water. However, in this case the fission products are trapped in the water, and the escaping neutrons produce radioactivity in dissolved substances such as sodium and chlorine, which are blown high into the air by the blast. The contaminated water falls down as rain and mist over a large area, producing a serious hazard to life, especially down-wind. Thus an underwater explosion, say in a deep harbour in the centre of a city, could spread radioactive material over many square miles and render those parts of the city uninhabitable.

Explosion of an atomic bomb beneath the earth would throw highly contaminated material round the rim of a large crater, say 800 feet in diameter. The activity in the crater and immediate neighbourhood would be very high, but the area contaminated would be much less than that resulting from an underwater explosion.

Owing to the absorption of γ rays and neutrons in the air, the increase in the area of radioactive damage due to the possible production of bombs of larger size is not as great as might be expected. Doubling of the energy release increases the area of radiation damage only by about 20%. Thus even hydrogen bombs, if they are ever usable, which could produce 1000 times the energy released by an ordinary bomb, would not give anything like as great an increase of radiation effects as of direct destruction by blast. In other words, with a hydrogen bomb, or even with a uranium bomb or a plutonium bomb of significantly greater energy output than the ordinary atomic bomb, the radius of destruction by blast will exceed the radius of serious damage by ionizing radiations. Presumably, for the smaller tactical bombs under development in the United States the effects of radiation are likely to be relatively greater than for the ordinary bomb.

Radiological Warfare.

A great deal has been said and written about the possibility that deliberate use might be made in warfare of the radioactive fission products or induced radioactivity produced in reactors. The total activities which can be prepared are very large, and millions of curies of radioactive substances could be made. The products from a

single reactor of large size generating 1,000,000 kilowatts of heat could contaminate 1000 square miles of country if the activities were spread uniformly, so as to deny permanent access to the area for some weeks.

However, though it is attractive to think of denying use of large areas to an enemy, it is not very feasible when account is taken of the great difficulty of carrying or distributing the radioactive substances. It appears that only in very special circumstances would such warfare be practicable or economical. It is essential that we be prepared for such warfare, as we were for gas in the last war, but it is improbable that this contingency will develop and for much the same reasons.

Plutonium is a very toxic substance if it is absorbed into the body. Like radium, it is preferentially absorbed in the bones and produces similar effects. Danger from plutonium poisoning might arise if an atomic bomb containing plutonium should fail to explode properly, merely sprinkling an area with the bulk of the charge. This hazard is probably not very serious.

Nuclear Reactors and Large-Scale Radioactivity.

We have mentioned already that direct radiation effects from large nuclear reactors producing plutonium or industrial power can be avoided by the use of efficient methods of shielding. Great care must be exercised to ensure that fission products do not enter cooling water used in such reactors, through punctures or corrosion holes in the protective coating over the uranium rods. These products, together with radioactivity induced by neutrons in impurities in the water, could find their way into streams or underground water supplies and cause serious trouble. Similar care must be taken that in the case of air-cooled reactors, such as those in operation in England, fission products and induced activity do not constitute a health hazard in the neighbourhood.

Continuous monitoring of the exposure to radiation of all workers near reactors is essential, and the health services associated with such undertakings demand rigid disciplines and continuous watchfulness.

After uranium has been exposed in a reactor for the optimum time for the production of plutonium, the rods must be removed, dissolved in acid and subjected to elaborate chemical processes for separation of the plutonium and for recovery of the uranium free from fission products. Since the radioactivity of a freshly removed rod may be equivalent to a ton of radium, it is clear that the handling processes and the subsequent chemistry must all be carried out by remote control, behind protective walls of concrete, lead and steel. The utmost vigilance is essential to avoid excessive exposure by operating personnel. The problem of disposal of the separated fission products is very real. It is impracticable to allow these to escape into rivers, the sea or underground, because of the danger that they will reappear elsewhere. In general such products are stored in solution in large underground tanks until they have decayed sufficiently to be released in great dilution. In Australia, where inland basins exist, like Lake Eyre, from which water escapes only by evaporation, it should be safe to dispose of fission products by casting them into blocks of concrete for transport and sinking them into the ooze.

Radiation Hazards of Nuclear Physics.

While the radiation effects due to γ rays and neutrons produced in the laboratory are small compared with those experienced with nuclear reactors or atomic weapons, they can constitute a very real hazard for research workers in this field. Questions of protection are complicated by the far greater energies of charged particles, neutrons and γ rays produced in modern accelerators. Owing to the changing nature of experiments performed and the impossibility of knowing beforehand exactly what radiations will be present, health precautions become very difficult to frame. When framed they are difficult to enforce, because experimental scientists are notoriously and necessarily undisciplined and impatient. Nevertheless rigid precautions must be taken and enforced so far as practicable.

Fortunately, the real dangers are experienced only by the workers themselves, and the community in general is quite safe.

Conclusion.

The development of atomic energy has produced very real radiation hazards for the community, both in war and in peace. However, the precautions necessary to avoid disaster are clear, and there is no need for undue apprehension. The primary hazard of atomic energy is undoubtedly that from the destructive blast of atomic bombs of growing efficiency and size. Even in the worst circumstances the effects of radiation are relatively far less important. Apprehension arises less from the facts of the situation than from publicity given to the mysterious and unpleasant effects of radiation and particularly from the primitive fear of sterilization in the human male.

A proper radiological service must be part of any scheme of future defence in war and of industrial medicine in peace, but it is a great mistake to assume that such precautions are of overriding importance.

THE USE OF CORTISONE AT THE REPATRIATION GENERAL HOSPITAL, HOLLYWOOD, WESTERN AUSTRALIA.¹

By BRIAN COURTNEY, M.B., F.R.C.S. (Edinburgh),
Perth.

My purpose this evening is to tell you about the use of cortisone in the Repatriation General Hospital, Hollywood. I shall tell you how we choose patients for cortisone treatment and how we manage them during that treatment. I shall merely allude to ACTH.

It is too early to say much about results or to give opinions on those results, because we have been using cortisone only for about four months and in a total of only 13 cases. Eleven of these patients are arthritics; one of them who is now receiving cortisone had ACTH originally.

I would stress at this stage that we at Hollywood are not conducting research, except in so far as one conducts research into the condition of all patients that one treats. We simply treat patients who we consider will give a satisfactory response to the hormone used. Such tests as are considered necessary for its safe exhibition are, of course, being carried out, and we vary procedure upon evidence from medical literature and upon that drawn from our own very small series of cases. We should like to do some fully controlled research, but we should need a larger medical staff, larger supplies of cortisone and, especially, a larger laboratory staff.

A Cortisone Committee has been set up in this hospital by the Repatriation Commission. Its duties are, firstly, to advise the senior medical officer on the suitability for treatment by cortisone or ACTH of patients presented to it, and secondly, to superintend the treatment of such patients as are placed on therapy with these hormones.

The committee consists of a visiting specialist physician, a full-time physician of the Repatriation Department, our resident pathologist, the visiting rheumatologist, a visiting specialist orthopaedic surgeon and myself. I act as secretary and, being a full-time member of the hospital staff, I am "the man on the spot" directing management of all our patients. Our radiologist reports on all X-ray films and is further consulted as required.

This committee interviews the cortisone candidate, with his medical history, relevant X-ray films and laboratory findings before it, and if it is thought necessary, an educational and social history is obtained as well. The two last-mentioned histories are produced by the educa-

¹ Read at a meeting of the Western Australian Branch of the British Medical Association on October 17, 1951, at Perth.

tional therapy officer and are used in the attempt to evaluate the economic potential of the patient. There is, of course, a record of a recent physical examination of the candidate in his case sheet, and one or all members of the committee can repeat this examination at the interview if thought desirable. If necessary, a further specialist's opinion is obtained for the interview. For example, an ophthalmological opinion was recently sought in a case of exophthalmos put up for treatment.

With all these data before it, the committee then decides whether to recommend treatment or not. When it is recommended for a patient we then advise the senior medical officer to apply to The Royal Australasian College of Physicians for the release of a supply of cortisone for that particular patient. It is with pleasure that I tell you that the College has granted us supplies of cortisone for every patient on whose behalf we have so far applied.

To date the committee has examined 23 candidates for treatment. We have accepted 13 patients. Of these 13, 11 are arthritics, one has an inflammatory eye condition, and one has scleroderma with arthritic manifestations. With so small a series of cases and with hardly any variation in the diseases treated, you will understand the hesitation I had before agreeing to speak on this subject.

Now how do we select patients for treatment? Firstly, they must conform to the list of conditions for which The Royal Australasian College of Physicians considers application for the hormone to be warranted. This list is as follows: (i) acute rheumatic fever with carditis, (ii) rheumatoid arthritis with florid and reversible manifestations, (iii) Still's disease, (iv) Addison's disease, (v) *status asthmaticus*, if life is endangered, (vi) acute disseminated *lupus erythematosus*, (vii) exfoliative dermatitis (severe), (viii) drug reaction, if life is endangered, (ix) pemphigus (severe), if life is endangered, (x) acute inflammatory eye diseases, if sight is endangered, (xi) very severe burns and/or shock, if life is endangered, (xii) other medical or surgical emergencies in which the use of cortisone would be a life-saving measure.

I would mention here that the use of ACTH, and of cortisone too, has been written up as a most dramatic and life-saving aid in the treatment of severe burns. The articles I have read are very convincing, but we have had no experience in this sphere at this hospital.

I believe that in view of the present short supply of cortisone and the expense of ACTH, diseases which are dangerous but normally of a limited duration are the ones of choice for treatment with these hormones. Here one helps the patient over a difficult hurdle and then ceases the exhibition of the drug. There are none of the worries, troubles and doubts associated with long-term maintenance therapy or with the consumption of large quantities of cortisone or ACTH in any one case, and at the same time the drugs are being used as a life-saving measure.

So far we have treated only the patients already mentioned, and so our experience is almost wholly with arthritis. In dealing with these arthritics, we decide firstly whether the condition is rheumatoid arthritis. Here comes our first difficulty, because the variations of rheumatoid arthritis seem to be legion. One may find one case which is clinically and radiographically one of typical rheumatoid arthritis, and on the other hand one may find a case in which the disorder in some places is typically rheumatoid arthritis and in others a mixture with osteoarthritis, or subacute infective arthritis, or both, and the whole picture is confused—even when one allows that there is secondary rheumatoid arthritis of infective origin. So we have decided to judge primarily on clinical manifestations, with X-ray films as a secondary aid. I believe, however, that this accurate diagnosis is still a big problem.

Tests carried out in each case for the committee meeting are as follows: (i) full blood count; (ii) a haemoglobin estimation; (iii) a haematocrit reading; (iv) erythrocyte sedimentation rate; (v) electrocardiography; (vi) X-ray examination of the chest; (vii) ward tests of the urine for sugar and albumin and, if indicated, a serum uric acid test. It would perhaps be wise to carry out a Wassermann or related test for latent syphilis as well.

Once it has been decided that the case is of a type of arthritis suitable for treatment, the next question is how much improvement can be expected. I think in terms of the classification of severity after Steinbroker, Traeber and Batterman, and find it a good guide. This is set out in the following tabulation.

Structural Change:

- Stage 1. Denoting absence of destructive joint changes.
- Stage 2. Minor destructive joint changes.
- Stage 3. Marked destructive joint changes.
- Class 4. Indicating advanced degrees of structural change with fibrous or bony ankylosis.

Functional Impairment:

- Class 1. Presenting no functional impairment.
- Class 2. Being handicapped but able to carry on usual activities.
- Class 3. Being those unable to perform usual duties.
- Class 4. Those who are bedridden or confined to a wheel-chair.

An article by Margolis and Caplan of Pittsburg (1951) gives their results obtained by the use of ACTH and gold. Their table of results in 56 cases gives a helpful guide to the improvement in the various degrees of severity that one might reasonably expect in this hormone treatment, by the use either of ACTH or cortisone (see Table I).

TABLE I.
(After Margolis and Caplan.)

Structural Change (Stage).	Functional Impairment (Class).	Number of Patients.		Total.
		Before ACTH.	After ACTH.	
I	I II III	0 3 2	5 0 0	5
II	I II III IV	0 14 11 2	11 4 1 3	27
III	I II III IV	0 4 12 6	3 12 7 0	22
IV	I II IV	1 1 1	1 1 1	2
Total		56	56	56

Here you see that of the five patients with no structural change (Stage I), all of whom had moderate functional incapacity, none had any residual incapacity after treatment. Of 27 patients with structural change of Stage 2 degree, no incapacity was shown at the end of treatment by 11. The majority showed considerable improvement. Of 22 patients with structural change of Stage 3 degree, 15 improved considerably in functional capacity and seven slightly. Of two patients with structural change of Stage 4 degree, neither improved in functional capacity at all.

The erythrocyte sedimentation rate seems to be a fair prognostic guide also. Those whose reading is approximately 20 millimetres or more in one hour seem to respond better and more quickly than those with a lower reading.

Having decided on this point of expected response of the disease to therapy, we then study the candidate's economic potential. This entails consideration of the possibility of his returning to useful work, and the period for which we think he is likely to remain at that work. Age and personality are important factors here.

Another important point is what I call the economic responsibility. Here one considers the importance of the job that the patient will do, as it affects the community at large, and the type of persons immediately dependent on that patient. Here of course a man or woman with a dependent family takes a high place, as also does, say, an experienced school-teacher and, if I may say it, so does

a doctor or a member of the building trade. The short supply of cortisone makes the economic potential and economic responsibility factors very important.

From the purely medical aspect, we of course eliminate those with contraindications to treatment. The main contraindications are as follows: hypertension, severe degrees of *diabetes mellitus*, chronic nephritis, hirsutism, tuberculosis, active syphilis, acute hemorrhagic tendencies, peptic ulceration, or coexisting secondary infection. Known psychotics and patients with psychopathic personalities we would not treat, nor those with Cushing's syndrome or congestive heart failure.

I would add here that other methods of treatment besides cortisone are considered in all cases before the final decision is made.

We follow one of two courses in commencing our treatment. The first is based on that recommended by the "Merck" pamphlet: 100 milligrammes given every eight hours for one day, 100 milligrammes given every twelve hours for one day, 100 milligrammes given daily for seven to fourteen days or less, the dosage then being broken down by steps.

The second course is based on one used by the American Council of Rheumatic Fever. This is as follows: 100 milligrammes every eight hours for one day, 100 milligrammes every twelve hours for four days, then 100 milligrammes once a day for sixteen days or so, the dose then being broken down further. We do not keep accurately to the full course now; we break the dosage down as speedily as seems clinically reasonable. Each dose is given as a single injection.

While under treatment the patients are given physiotherapy. This is considered important, because it enables maximum advantage to be taken of the considerable improvement in joint movement and ensures mobilization to the fullest extent. I may mention here also that the educational therapy officer undertakes rehabilitation arrangements in cases in which it is necessary.

We next try to find the optimum maintenance dose for the individual patient. This is easy for some, and at present we have one receiving 30 milligrammes per day, one receiving 55 milligrammes, one receiving 60 milligrammes, and one receiving 75 milligrammes. We hope to reduce these doses further, but this may well be an unfounded hope. The main dosage difficulty is how little one can give as an effective continual maintenance dose. At present we hesitate to give more than 75 milligrammes per day, because we do not see the end of it all yet. Boland of Los Angeles has treated patients for fourteen months and successfully withdrawn cortisone, and we eagerly await his promised report on really long-term treatment.

So far our main immediate worry in this therapy is the "mooning" of the face and development of the "buffalo hump". We are trying to control this with decreased caloric intake. Of course control would be better with a decreased dose; but we do not want to decrease the dose given to one of our two "moonfaces", because he is almost symptom-free and has returned to work. He prefers the fat face to joint pains, and we are letting him go on as he is at present. The other "moonface" is not free of his pains, though very much improved, and he is receiving 75 milligrammes a day. His case is awkward, for if we increase his dose still further to relieve his pains, I think he will get a great "moonface" and "buffalo hump". If we decrease his dose to lessen his fat face his pains will grow worse. If we keep him on as he is he will probably be well enough to return to work soon. He will, we hope, suffer no damage to anything but his vanity, which is not pronounced anyway, so with him too we wait and see while decreasing his caloric intake.

A thirty-year-old woman, also receiving 75 milligrammes per day, is now threatening a "moonface", and she becomes a very difficult problem. She is much improved with regard to her arthritis, and although not free from symptoms or signs, we hope that she will recommence work before long. She is a worry because a "moonfaced" female of thirty is much worse off than a "moonfaced" male of fifty.

It is of interest that this "mooning" of the face has, as a rule, not been in parallel with any pronounced increase of weight or general adiposity.

The above-mentioned doses are our highest maintenance doses; but Boland of Los Angeles (1951) used a maintenance dose varying from an average of 80.5 milligrammes per day in "severe" groups to one of 37.5 milligrammes per day in "mild" groups. I believe that he also used up to 125 milligrammes daily for four months as a maintenance dose for at least one patient, with no apparent worrying ill-effect. However, at present we in this hospital are reluctant to use over 75 milligrammes per day, and feel that we should not accept anyone for treatment who is likely to need more than that until we learn more about the effects of really long-continued administration, and until the supply of cortisone is much greater.

It seems that uninterrupted maintenance therapy with the hormone is much more satisfactory than intermittent courses, because most patients do seem to "slip" fairly quickly when taken off treatment. One interesting point here is that when they do "slip" they usually have more severe pains than any they have ever had before. This may be due to their forgetting the previous degree of severity, but I do not consider that this is so in all cases. I shall refer to this again later.

There may be a way to overcome the difficulty of ill-effects of long dosage in some cases by using gold in conjunction with cortisone. Margolis and Caplan of Pittsburgh have used gold with ACTH, and they state that they have been able to obtain improvement with ACTH and "Solganal"; they then cease to administer ACTH, and with "Solganal" alone maintain satisfactory improvement for periods of thirty to two hundred and twenty-nine days. On the other hand, most of their patients treated with ACTH alone relapsed quickly on cessation of treatment. I have not read of gold being used in conjunction with cortisone, but with the agreement of my colleagues I shall try it on one or two of our patients needing the larger maintenance doses.

As I have said, we try to find the optimum maintenance dose, fully aware that it may vary up or down from time to time in the same person, and indeed, that some patients may slip from control so far that continuation of treatment is contraindicated.

Once we have worked out the optimum maintenance dose, our object is to send the patient out of hospital receiving that dose and to administer it orally. For oral dosage we are using Merck's "Cortone" as prepared for intramuscular injection. One quarter of the daily dose is taken four times a day, between 6 a.m. and 10 p.m. as a rule. We make a mixture of it by adding syrup. The "Cortone" is extremely bitter, and we render it as palatable as we can. It is stomachied quite well and in our five cases in which it is now being used the maintenance dosage given is the same as that previously given by injection. In these cases it seems to be as effective given orally as by injection; in fact, two of our patients say that they feel better on the oral dose than on the equivalent injection. The convenience of the oral route as compared to the parenteral route is obviously immense, and all patients greatly prefer it. When "Cortone" is taken orally the effect is speedy but of shorter duration than when injected; hence the divided doses.

All patients are admitted to hospital for stabilization of treatment. An eosinophile cell count is carried out and that, with previously mentioned tests, forms the base line for comparison of future tests.

During the course, blood pressure and weight are checked daily for one week, and every week thereafter. A diet of low salt content is given for one week and then varied as indicated. A fluid chart is kept for one week, and urine is tested for albumin and sugar twice a week. An erythrocyte sedimentation rate, eosinophile cell count, leucocyte count and haematocrit reading are made every week. All results are recorded on a form that we have prepared, and we also record the joint condition on a second form.

We first carried out the laboratory tests three times a week, but we have now decided that it is not necessary

to make them so often. They seem to be, at best, a very rough guide to response, and the total leucocyte count with relative lymphopenia seems to us to be as good a guide as any. The eosinophile cell count seems, in our limited experience, to vary unpredictably with the dosage of cortisone, although it runs nearer the expected variation with oral dosage than with parenteral dosage. These cells may vanish completely from the blood picture in ACTH therapy. The eosinophile cell response to cortisone does not appear to be any guide to eventual prognosis. The erythrocyte sedimentation rate also seems to vary with no rhyme or reason, but the hemoglobin value invariably improves.

Our main control under therapy, then, is really clinical observation, including ward tests. The serum sodium content, serum chloride content, serum potassium content and urinary ketosteroid excretion are estimated when clinically indicated. We should like to perform all these tests together with a serum albumin and globulin test, and also a urate and creatinine excretion test, for interest, completeness and the drawing of impressive graphs; but it is impracticable here, solely because of the small size of our laboratory staff, and in truth such tests appear to be unnecessary for routine control of treatment in cortisone therapy.

Our results so far have been heartening, but we have had to cease treatment in two cases. (Boland of Los Angeles had to cease treatment in 16 out of a series of 76 patients for various reasons.)

One of the patients we ceased treating promised well and was actually working on repairs to his motor truck when he began to "slip". He also complained of increasing tachycardia and chest pains and became a "difficult" patient. Having in mind the cortisone suicides of the United States of America and seeing that he would need a fairly high maintenance dose, we reluctantly decided that the committee had selected what proved to be an unsuitable patient, so we tapered off his cortisone and then stopped it. He relapsed in a few days, at least as far back as before his course, but he is not keen to start again. Some of his improvement was probably wishful thinking and some due to weather variation; but at one stage rheumatic nodules almost vanished and all swelling and stiffness decreased and movement increased.

It is noteworthy how greatly the pain of arthritic patients receiving cortisone varies with weather changes.

Our second failure was due to too much optimism on our own part, but we learnt from the case.

This patient had Class 3 functional impairment and Stage 3 structural impairment and was a "trier"; but after early promise he began to "slip", and then he developed a small pulmonary effusion. This effusion cleared in about two days; but we shall not treat him again.

Of our other eight arthritic patients, three are doing extremely well so far. Two of them are at work and one is on demobilization leave. The fourth is doing very well and has begun a rehabilitation course. Two more are doing satisfactorily, and one, early in treatment, promises to do extremely well.

The last of the eight is rather an unknown quantity, who improved most dramatically on ACTH last July, and then, when we switched him to cortisone, did only moderately well. At that time we kept religiously to "courses" of therapy, and between courses he relapsed badly. He is now improving moderately on a fairly heavy cortisone dosage; but I have a feeling myself that he would be a good man to try with ACTH and gold.

I would say at this stage that in order to give treatment to the most suitable arthritics under repatriation care, a survey of all such patients on our books is being undertaken, with a view to producing a priority list. This will eliminate the possibility that those who actually come into hospital may be our only candidates, when there must be many suitable and deserving patients "sticking it out" at work.

We have not treated any patients with Marie-Strümpell's syndrome. American journals speak of much improvement in some cases and little in others, and it probably depends on the severity of the disease in the individual case, as in rheumatoid arthritis.

We have one patient suffering from scleroderma with joint pains whom we have treated with cortisone. We have apparently halted the rather speedy spread of the affected areas of skin and certainly softened its texture. The patient is at present resting between "courses", and as a result of studying medical literature we shall probably give her some ACTH for the next course. We have been treating her on "courses" rather than on continuous therapy, because we are still assessing effects of cortisone in her case.

That covers our limited experience with cortisone so far. Our experience with ACTH is even more limited, and tonight my only comment on it is that ACTH requires much closer watching by laboratory cover than cortisone does, both during administration and during the weaning off process.

Other apparently multitudinous uses of these hormones have been reported, but we have had no experience of them.

I should like to say a little about the ill-effects of this treatment. They are as follows: (i) sodium and water retention; (ii) congestive heart failure with ascites and peripheral or pulmonary edema; (iii) potassium depletion; (iv) thrombotic phenomena; (v) Cushing's syndrome; (vi) diabetes mellitus; (vii) hypertension; (viii) peptic ulceration; (ix) psychotic states; (x) insomnia; (xi) exacerbation of tuberculosis; (xii) hirsutism; (xiii) acne; (xiv) striae; (xv) amenorrhoea; (xvi) delayed wound healing; (xvii) dysenteric ulcer perforation; (xviii) "moonface"; (xix) "buffalo hump"; (xx) pigmentation; (xxi) headache; (xxii) weakness; (xxiii) osteoporosis—especially spinal; (xxiv) loss of hair.

These are some of the recorded ill-effects. We have seen sodium and water retention in two cases; it was cleared up by restriction of salt intake for one week.

One of our patients suffered from severe insomnia and for a time was sleeping for only one or two hours a night. This was not only her story, but was closely checked by members of the nursing staff—who, by the way, did not turn their lighted torches on her face to see if she was awake. We had one patient who developed mild acne. We ignored this and he recovered.

One of our patients developed an abscess of his buttock, at the injection site, which speedily spread over the whole of the buttock. It was incised with one small incision and drained well for one or two days, but it was nearly three weeks before the lips of the incision adhered. This was abnormally slow healing, and in view of the opinion given by many that cortisone delayed healing, we thought that it might have had something to do with the delay in this case, even though therapy was discontinued on the day of the incision.

Against this I would state that I have read of a number of cases in which neither cortisone nor ACTH had any ill-effects on the healing of operation wounds or on the "taking" of skin grafts. Furthermore, I have read that in some cases it seems to have accelerated epithelialization of burnt areas. The secret of these conflicting reports may well be in the dosages used in the various cases. The cases of "moonface" I have already mentioned. Three patients have had slight headache.

With regard to the osteoporosis, spontaneous fractures have been described in this connexion. Apparently elderly people are the most susceptible, and in them the spine is the usual seat of the osteoporosis. It would appear that all elderly people should have their spines radiologically examined before being treated with these hormones.

With regard to psychotic states, I understand that there have been several suicides in the United States which are blamed, in some part at least, on cortisone, and this apparently not owing to disappointment in treatment or recurrence of pain after cessation of therapy. I believe also that acute abdominal conditions can develop while the patient is treated with cortisone and its signs can be "masked". All these ill-effects are more likely to occur with ACTH than with cortisone.

Conclusions.

Cortisone does not (nor ACTH for that matter) cure rheumatoid arthritis, but it does to a limited extent appear to lessen the ill-effect of the causative agent, leading to a greater well-being of the sufferer. Part of this improvement may well be an analgesic phenomenon—hence it has been called "glorified aspirin"; but there is a further action which allows lessening of stiffness and swelling and increase in mobility in all joints affected by rheumatoid arthritis. It is not a "magic drug" for this complaint, and I warn all our patients that it is not. I also warn them that it may or may not help them, and that they may or may not be able to tolerate it. Further, the end result of prolonged therapy—that is, over a period of years—is not yet known, and it would appear that years of therapy may be necessary, it being assumed that the human being can stand it. Such therapy would last until the disease burnt itself out—if it does burn itself out.

In using cortisone and ACTH we apparently bolster up the body's reaction to the stress situation, but this reaction is a preservation one and not necessarily curative of anything. Thus, in using the hormone, we are of necessity interfering with the bodily hormonal balance. This interference tends to make the gland normally producing the hormone "lazy", and on cessation of artificial introduction of the hormone the gland is "going slow" and the patient is not producing his own normal amount of the hormone concerned. This asthenia of the affected gland seems to right itself in about two weeks as a rule, but in some cases I believe it may take up to three months.

It seems to me that it is probably this asthenia of the adrenal cortex which makes the relapse between courses of cortisone in rheumatoid subjects sometimes give worse pain than was present before the course began. It would appear that this is because at that stage they have not even got their own full amount of "home-made" cortisone in circulation.

That concludes my talk; but I should like to point out that I am well aware that I have left out a great deal about cortisone and ACTH. I have not mentioned just what these hormones are, nor how much more complicated the glandular response of the body is to an injection of ACTH compared with an injection of cortisone. I have not mentioned a number of uses of these hormones, or how ACTH seems to be superior to cortisone in most of the skin diseases in which both have been tried, at least when treatment is commenced. I have not mentioned dosage of ACTH at all. I have not elaborated many of the points that I have brought up.

However, it has not been my intention to produce a comprehensive paper on cortisone and ACTH; such a paper from me would have to be almost entirely a précis of many papers written by other people. I set out to give a talk primarily on how we are using cortisone at the Repatriation General Hospital, Hollywood, and on the lines along which we are thinking.

I realize that there is an enormous amount yet to be learnt about this whole subject, and we watch the journals closely; and I realize also that this therapy may, in the end, prove to be of far less value and rather more dangerous than it is at present believed to be. I stress this because we must not, at this stage, become too wildly enthusiastic. On the other hand, I assure you that all our "satisfactory" patients have said most definitely that the relief that cortisone has afforded them is infinitely greater than that afforded by any other drug that they have experienced; in fact, the thanks and gratitude shown by several of them have been both thrilling and embarrassing.

Acknowledgements.

I acknowledge with thanks the permission of the Chairman of the Repatriation Commission to publish this talk, and the assistance rendered by the members of the committee in preparing the script for publication.

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SCIATICA AND SUCH CONDITIONS OF THE BACK AS ACCOMPANY IT¹

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Definition of Sciatica.

SCIATICA is a pain in the leg in the distribution of the branches or of the segmental nerves composing the sciatic nerve. Unless the location of the pain is confined to the distribution of some part of the sciatic nerve it is not called sciatica.

The Composition of the Sciatic Nerve.

The sciatic nerve arises from the sacral plexus deriving fibres from the fourth and fifth lumbar nerves and the first, second and third sacral nerves. In the main it is formed by the fifth lumbar and the first two sacral nerves. The roots of these nerves arise from the spinal cord in the region of the last thoracic vertebra, pass down in the subarachnoid space, and emerge opposite the corresponding vertebrae. The sacral plexus containing these nerves passes round the side wall of the pelvis and into the gluteal region through the great sciatic notch of the pelvis. The sciatic nerve then passes down the back of the thigh to divide into the medial and lateral popliteal nerves and

¹ Read at a meeting of the South Australian Branch of the British Medical Association on July 26, 1951.

more distal branches. However, the nerve roots from which the sciatic nerve is formed are not entirely distributed through the sciatic nerve. They travel along various other nerves also, such as the posterior cutaneous nerve of the thigh, the gluteal nerves, and the nerves to the perineum. There are associated with them autonomic fibres which supply blood vessels and viscera of the leg and pelvis. The spinal nerves concerned each divide into an anterior and a posterior primary ramus. Therefore, although the sciatic nerve is formed from the anterior primary rami, any lesion affecting one of these nerves before it divides into its two main branches would be expected to give pain referred posteriorly, as well as anteriorly along the sciatic nerve. The posterior primary rami of the nerves concerned are distributed over quite a small area of the buttock near the posterior superior iliac spine. Therefore, it will be difficult to separate the pain referred along any one of them as they are so close together.

The Distribution of the "Sciatic" Spinal Nerves.

Each nerve is distributed to the skin along certain overlapping strips, which are clinically well defined. These strips of skin are called dermatomes, so that it is possible on clinical grounds to draw up a chart of the dermatome supply to the skin of the leg (Keegan, 1944). A pain caused by affection of one of these nerves will show on an appropriate skin area or dermatome; but it may reach this area by a variety of nerve paths other than the sciatic nerve itself. There is a fairly characteristic pattern of muscle supply because these nerves will be involved to a greater or lesser extent in the supply of certain muscles. The autonomic system involved in sciatica will show by accompanying disturbance in blood circulation, and it is possible that groin pain, which at times accompanies sciatica although the sciatic nerve has no inguinal distribution, may reach that site because the sympathetic fibres in the sciatic nerve come from the lowest thoracic and upper lumbar sympathetic outflow, the somatic distribution of these segments being in the groin.

Vulnerable Areas in the Course of the Sciatic Nerve.

The anatomical relations of the nerve expose it to a variety of affections. The long course down the vertebral canal in the *cauda equina* may lead to pressure by carcinomatous deposits in the lumbar part of the spine or by spinal cord tumour. As each nerve leaves the dural sheath to pass out through an intervertebral foramen, it crosses an intervertebral disk at a site where the disk commonly ruptures. The sacral plexus passes across the side of the pelvis and may be involved by inflammatory or malignant processes originating in the pelvic viscera. In the gluteal region an intramuscular injection may be given into the sciatic nerve itself. Further down the leg, injury or inflammation may involve the nerve with other adjacent structures.

The most pertinent of these areas is the passage of the spinal nerves out of the dural space and through the intervertebral foramina in the region of the lumbosacral junction of the spine.

The Lumbo-Sacral Junction.

The mobile lumbar part of the spine meets and transmits the body weight to the fixed sacrum at this point. It would be fair to expect such a region to be liable to injury, and this is the case.

The mechanical features attaching the fifth lumbar vertebra to the top of the sacrum are three: the intervertebral disk in front, the ilio-lumbar ligament laterally and the interlocking apophyseal joints behind.

The Intervertebral Disk.

The intervertebral disk is a strong, elastic cartilaginous joint between two vertebral bodies. It consists of an outer part, the *annulus fibrosus*, and an inner central area, the *nucleus pulposus*. The annulus is composed of concentric layers of fibrocartilage, while the softer nucleus is held under tension inside it. The disk is supported in front

and behind by a longitudinal ligament, but postero-laterally, where the annulus is thinnest, there is no such support. This weak point is the commonest site of disk rupture.

The fifth lumbar disk at the junction of the mobile and fixed spinal segments must allow more movement and transmit more weight than those above it. Therefore, it is larger and stronger than the others. If movement is impossible, as in sacralization of the fifth lumbar vertebra, the disk will be narrow. If the fifth lumbar disk becomes narrow after an injury, its reduced capacity for movement

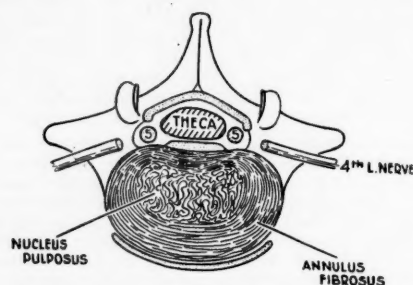


FIGURE 1.

Transverse section through the intervertebral disk above the fifth lumbar vertebra. Note the narrowness of the annulus in front of the fifth lumbar nerve.

will necessitate the fourth disk above it taking on a major portion of its movement. The fourth lumbar vertebra will then be the end of the mobile lumbar part of the spine, but will lack the support of a suspensory ligament like the ilio-lumbar ligament.

The Ilio-Lumbar Ligament.

The ilio-lumbar ligament is a very strong structure, and the degree of tension it can sustain is shown by the massive transverse processes on the fifth lumbar vertebra from which it arises. If the position of this transverse process in relation to the pelvic girdle is such that it cannot act as the anchor of the suspensory ligament (that is, if there is a high-set or a low-set fifth lumbar vertebra in relation to the bony pelvis), then the transverse process of the fifth lumbar vertebra will be small and the fifth lumbar vertebra will be without the support of this valuable suspensory ligament.

The Apophyseal Joints.

Interlocking behind the vertebral canal, the apophyseal joints are ordinarily loosely related one to another. In flexion and extension of the spine they slide and rock one on the other, and there is no precision in their movement. They, therefore, should normally form a limiting factor in the extremes of movement, rather than a smooth working joint. It is important to remember this, because it indicates that it would be difficult to place these joints at a disadvantage by altering the relationship of the articular surfaces one to the other. Such alteration would occur in narrowing of the intervertebral disk in front of it.

The Unstable Lumbo-Sacral Junction.

The preceding paragraphs on the structure of the lumbosacral junction will indicate some of the ways in which it may be inadequate. There is a wide range of conditions in which it is congenitally inadequate for its function. These include partial sacralization of the fifth lumbar vertebra, sacralization of the fifth lumbar vertebra, a high or low setting of the fifth lumbar vertebra in relation to the crest of the ilium, defects of ossification which may give rise to displacement as in the familiar condition of spondylolisthesis, and asymmetry of lumbosacral apophyseal joints. It does not include *spina bifida occulta*, which is common at this region and consists of a failure

of the laminae of the vertebra to fuse posteriorly. It has been shown in surveys of manual labourers that those with congenitally unstable lumbo-sacral junctions are more prone to develop low back strain than those in whom the joints are congenitally stable. Therefore, in conditions of low back pain it is important to look for these congenital stigmata in X-ray films.

The Relations of the Intervertebral Disk.

In a transverse section of the spinal column it will be seen that behind the disk there runs in the mid-line the posterior longitudinal ligament, which strengthens this part of the disk. In front is the anterior longitudinal ligament. Moreover, the *annulus fibrosus* is thick in front and at the sides, but postero-laterally, where it is without the support of the posterior longitudinal ligament, it is not only relatively unsupported but also relatively thin. Immediately behind this portion there passes a nerve, which is to pass out of the vertebral canal opposite the vertebra next below. The nerve corresponding to the vertebra lies too far laterally to be opposite this weak point. Behind the nerve passing this point there are the apophyseal joint and the edge of the *ligamentum flavum*, which is a strong elastic ligament passing between the laminae of the vertebrae. If the side of an intervertebral foramen is viewed it will be seen that the nerve issuing from it has above and below it the pedicle of a vertebra, behind it the apophyseal joint and the *ligamentum flavum*, in front of it the *annulus fibrosus* of the disk. If by injury the *annulus fibrosus* is cracked opposite this weak point and there occurs a herniation backwards of the *nucleus pulposus* through that crack, the bulging will squeeze the nerve corresponding to the vertebra next below on to the margin of the *ligamentum flavum*. This is the mechanism of compression which gives rise to sciatica in herniation of a ruptured intervertebral disk. It has recently been suggested that compression does not occur so much as tension of the nerve in passing over the bulging herniation (O'Connell, 1951).

In spondylolisthesis the forward shift of the vertebra will make the intervertebral foramen occupy a relatively posterior position in relation to the canal above. Compression or tension of the issuing nerve is thus possible. Sometimes the whole of the back of the intervertebral disk is damaged and the posterior longitudinal ligament stripped from the bone sufficiently to allow the herniating nucleus to burst out posteriorly and compress not one nerve but most of the nerves. This gives a *cauda equina* lesion from massive retropulsion of an intervertebral disk.

The Aetiology of Disk Injuries.

The aetiology of disk injuries is still undecided. To quote a recent editorial in *The Journal of Bone and Joint Surgery*, February, 1951:

The analogy of disc protrusions to an automobile tyre failure seems apt. The tyre, when it leaves the factory may have a defect in the fabric (congenital weakness) so that it blows out while rolling along a smooth road. A tyre may blow out when it strikes a stone or curb (acute trauma) or it may give way thousands of miles later. A tyre exposed to gasoline (petrol to our English friends) ages rapidly, and degenerative change produces early tyre failure.

Two Clinical Types of Sciatica.

Sciatica may be separated into two large classes clinically. One is compressive sciatica and the other is irritative or referred sciatica. Such a classification may be ill-founded or unwise, but it is certainly most useful.

Compressive sciatica has sciatic pain accompanied by physical signs of interference with nerve function. Besides the patient's complaint of sciatic pain there will be numbness or paraesthesia of skin, weakness and tenderness of muscles, or alteration of tendon reflexes. Irritative sciatica will have symptoms of sciatic pain without such physical signs. These two groups will merge together, because minor degrees of compression or tension give a picture showing nerve irritation with minimal interference with nerve conduction.

The Main Causes of Sciatica.

The main causes of sciatica can be listed as follows in their approximate order of frequency.

1. Compressive sciatica: (a) herniation of intervertebral disk; (b) spondylolisthesis; (c) malignant involvement; (d) inflammatory involvement; (e) fractures or soft tissue injuries along the course of a nerve.

TABLE I.
Analysis of 135 Cases to show Sex Incidence and Type of Sciatica.

Sex of Patient.	Number of Cases.	Type of Sciatica.	
		Compressive.	Irritative.
Male	93	89	24
Female	42	28	16
Total	135	95	40

2. Irritative sciatica: (a) lesser degrees of herniation of an intervertebral disk; (b) spondylolisthesis; (c) lumbo-sacral back strain; (d) *spondylitis deformans*; (e) ankylosing spondylitis; (f) referred pain from pelvic organs; (g) unknown causes. It should be noted that the unknown causes probably rate third or fourth in this list.

TABLE II.
Age Grouping and Clinical Types of Cases of Sciatica.

Clinical Type.	Age Grouping.					
	10-20 Years.	20-30 Years.	30-40 Years.	40-50 Years.	50-60 Years.	60 Years Onwards.
Compressive ..	1	20	35	22	11	6
Irritative ..	1	4	11	15	5	4
Totals ..	2	24	46	37	16	10

There seems little disagreement now that the bulk of the compressive sciaticas are due to herniation of an intervertebral disk or spondylolisthesis. This presumes that a general examination has excluded malignant or inflammatory processes, fractures or soft tissue damage. The only danger is in the presence of a spinal cord tumour, fortunately a rare condition.

TABLE III.
Causes Provisionally Diagnosed.

Cause.	Number of Cases.
Disk lesions	96
Spondylolisthesis	11
Miscellaneous (unknown, tumour of cord, spondylitis et cetera)	28

Clinical Pictures.

Firstly, we shall consider compressive sciatica due to a herniation of an intervertebral disk. The great majority of cases of this condition occur in patients below the age of forty-five years, because after that age changes in the disk seem to preclude herniation. The majority are in males, although the condition is not at all uncommon in females. The majority occur in the left leg.

There is a story of previous low-back pain possibly extending over a number of years. In one classical type

there are recurrent acute attacks of low back pain precipitated by strain or posture, terminating in an attack with radiation of pain down the postero-lateral aspect of the leg to the foot; that is, recurrent low back strains finally leading to sciatica. Sometimes an acute low back pain is followed almost immediately by the development of sciatica. Occasionally there is no previous history of backache. The type of backache which precedes sciatica or accompanies it is that of lumbo-sacral strain. It is precipitated by exertion, jolting or posture and relieved by rest. It is accompanied by muscle spasm and complete disability when it is at its worst. It is not necessarily confined to heavy exertion, such as carrying bags of wheat, but posture and "timing" seem to play a part, so that a cough while the subject is leaning over cleaning the teeth may precipitate this pain.

The sciatic pain is of a radiating type necessarily. It is an ache with exacerbations of stabbing pain, which may first be felt in the buttock and slowly spread down the leg. It is located in the postero-lateral aspect of the thigh, the lateral or anterior part of the leg, the ankle and some part of the foot. It is not usually a continuous strip of pain, but it is localized in two or three portions of a strip corresponding to a dermatome. Of these areas of localized pain, I believe the lowest is the most significant in regard to the affected dermatome. The sciatic pain is usually worse when the patient is under exertion, best when he is at rest; but it may be easiest when the patient is moving quietly about, and he may prefer that to lying down. Almost invariably prolonged sitting is uncomfortable, as in a theatre show or prolonged motor rides. Coughing, sneezing and straining give sudden sharp pains bursting down the leg. Many patients have noticed some twisting of the back from sciatic scoliosis, some numbness or pins and needles of the skin, sometimes some definite muscle weakness. Quite a number complain that the pain also radiates to the groin.

It is essential that a full examination should be made, and for this to be done men must strip and women should wear only brassieres and knickers. It is unfortunate that in women the greater percentage of subcutaneous fat makes minor degrees of muscle wasting more difficult to detect. If the sciatica is moderately severe the patient will usually stand or sit twisted on one buttock when giving his history and will move cautiously when undressing. If the patient stands with his back to the examiner, this allows observation of posture, spinal movement and wasting of muscles of the buttock, thigh or calf. The patient should indicate the areas of pain and the areas of any affected skin sensation. Pressure between the spinous processes of the vertebrae will usually show tenderness at the level of the injured disk. Other tender points will be found along the regions reckoned to be the site of "fibrositic" tenderness and of nodules. If the patient stands on the heels, and then supports the body weight on the toes, each foot in turn, this gives an indication of loss of power of dorsiflexion or plantarflexion. Ankle jerks are best elicited and compared with the patient kneeling upright on the end of a couch; the knee jerks can be tested with him sitting on the end of the couch. On the affected side there will usually be an absence or great reduction of the ankle jerk and some alteration of the knee jerk—usually reduction but possibly exaggeration. With the patient lying supine, the clinical examination from head to foot is carried out, including the recording of blood pressure. In particular, straight leg raising is tested both passively and against resistance. On the affected side it is usually greatly reduced because of pain in the back of the thigh and buttock. Only the simplest testing of skin sensation is necessary, such as the rubbing of comparative areas of the two legs or several areas of one leg. The patient then turns to a prone position. The prone knee-flexion test is performed, and occasionally, when the straight-leg raising has been little reduced, the buttock on the affected side will rise high off the couch, indicating a positive form of Ely's or Ober's sign. Prone straight-leg raising against resistance will indicate the power of the gluteal muscles, and if the patient resists straightening of the flexed knee in the prone position, a test of hamstring power is provided.

In the commonest form of compressive sciatica, which concerns the first sacral nerve, the pain is referred down the leg to the outer side of the foot and reaches two or perhaps three toes. There is extreme or considerable limitation of straight-leg raising, but the response in the prone knee-flexion test is negative. The main muscle weakness is that of plantar flexion of the foot and weakness of the hamstrings.

There is another less common type, which I believe from my records is characteristic of affection of the fifth lumbar nerve, in which there is little or no limitation of straight-leg raising, but the response in the prone knee-flexion test is strongly positive. The pain is referred down in front of the shin to the dorsum of the foot or over towards the great toe. The main muscle weakness is that of dorsiflexion of the foot. There was a time when limitation of straight-leg raising was the definite sign of sciatica, and if this belief persists then the less common type as above will be disregarded.

If spondylolisthesis is present there should be a noticeable "steppage" in the spinous processes indicating a forward shift of the vertebral column. The highest prominent spinous process making the "steppage" belongs to the vertebra which has slipped forwards and does not accompany that vertebral body in its displacement. If this is not remembered then many acute lumbo-sacral angles may appear to have a "steppage". It cannot be emphasized too strongly that the physical signs accompanying a case of compressive sciatica are seldom so apparent that they cannot be missed. Once sought, however, they appear quite obvious.

The clinical features of compressive sciatica may be summarized as follows.

1. Complaints: Low backache radiating to one buttock and down the leg to the foot. Aching pain, worse on exertion. Severe stabbing pain on coughing. Relief of pain by resting or gentle movement. Numbness, "pins and needles" or weakness of the leg.
2. Signs: Spasm of back muscles with scoliosis. Wasting and flabbiness of buttock and calf. Reduction or absence of ankle jerk. Reduction of response in the straight-leg raising or the prone knee-flexion test. Numbness of the skin of the leg or the foot.
3. "S1 nerve type": Pain going to the outer side of the foot including the outer two toes. Great reduction in straight-leg raising. No change in prone knee-flexion (Ober's or Ely's sign not present).
4. "L5 nerve type": Pain going across the top of the foot to the great toe. Little change effected in straight-leg raising. Strongly positive response in prone knee-flexion (Ober's or Ely's sign present). "Drop foot."

In the case of irritative sciatica the story may be much the same, but there are no physical signs indicating interference with nerve function. The only ones which may be present are localized tenderness of the back or along the course of the sciatic nerve, perhaps some limitation of straight-leg raising or prone knee-flexion, but certainly no alteration of muscles, reflexes, skin sensation or vasomotor supply.

In ankylosing spondylitis, when the patient is stripped and standing up, there should be a noticeable stiffness of the whole of the back or at least of the lumbar region; there is a great restriction of chest movement, so that the total range of movement of the chest at the nipple is less than an inch and a half. The story of preceding pain is usually that of a pain which flits from place to place. It is in varying places in the back, or it may radiate from the back and appear as abdominal pain, chest pain and so forth. It sounds unconvincing, as though the little pains many of us get from time to time are related with undue emphasis by the patient. Many sufferers from this complaint have at some stage been regarded as neurotic.

In no form of sciatica is there a definite correlation between the degrees of pain and the physical signs present at examination. Severe compressive sciatica may progress from agonizing pain to numbness and weakness, which the patient regards as considerable relief. In a case of recover-

ing compressive sciatica in which the cause has disappeared certain physical signs will remain, and some pain may lead one to suppose that the cause is still present. The reduction in pain and the slighter physical signs should put one on guard.

Investigations.

What investigations are necessary? In every case a pelvic examination and urine test should be performed. These usually yield negative results, but occasionally are exceedingly helpful. It is always necessary for the examiner to make an X-ray examination of the lumbosacral part of the spine, seeking not to confirm the diagnosis of a narrowed disk but to show spondylolisthesis, Paget's disease, abscesses, fractures, neoplastic deposits and the like. The diagnosis of most cases of sciatica rests on clinical evidence, not on X-ray examinations of the spine. If an X-ray examination shows a narrowing of the fifth lumbar disk, the herniation may still be from the apparently normal fourth lumbar disk above it. In the hope of avoiding a missed diagnosis of spinal cord tumour, lumbar puncture was performed for a considerable period. However, I found varying increases of protein. The protein content may be normal or may be increased to over 100 milligrammes per centum, so that examination of the cerebro-spinal fluid has now been abandoned. Occasionally, a myelogram with "Pantopaque" is warranted if a *cauda equina* lesion exists or if a spinal cord tumour is suspected.

Duration and Course.

When considering the course of sciatica in general, I consulted "Osler's Text Book of Medicine" and found that from 1898 until the latest edition there has been little change except in wording of the paragraph in the book; to quote:

The duration and course are extremely variable and depend greatly on the cause. As a rule, it is an obstinate affection, lasting for months, or even, with slight remissions, for years. Relapses are not uncommon, and the disease may be relieved in one nerve only to appear in the other. In the severer form the patient is bedridden, and such cases prove among the most distressing and trying which the physician is called upon to treat.

I think this an accurate general summary of the condition. In the 1930's I can recall treating persistent sciaticas which lasted for many months into a year or more, with great distress to myself and the patient, particularly of course to the latter. I have twice seen extremely severe compressive sciaticas suddenly cease. One was in a prominent athlete and apparently disappeared overnight while he was asleep. Another man I saw some years ago who could neither work nor sleep; late one night, when creeping down two steps leading to the kitchen to get a drink, he slipped, fell with an agonizing sciatic pain, and collapsed in a faint on the floor. Although I observed him thereafter for eighteen months and saw the signs of nerve compression slowly disappear, he never again had sciatic pain.

Treatment.

I was brought up to use a variety of treatments: rest in bed with salicylates and iodides, physiotherapy, plaster jackets and spicas, epidural injection and stretching under anaesthesia. Each method or combination had its successes, but the selection of patients for treatment was poor. Many made partial recoveries only. The course was usually prolonged and the absence from work not inconsiderable, and changes to light occupations were frequent. There have been two recent reports of a series of compressive sciaticas treated conservatively which do not indicate that these conservative measures are any quicker or more reliable than they used to be (Durbin, 1948; Colonna and Friedenberg, 1949).

I consider that it is necessary not only to relieve the condition but to relieve it as quickly as possible, with a minimum of absence from work and with the least likelihood of necessity for change of occupation. As the condition does not endanger the patient's life, neither should his treatment.

In the case of compressive sciatica considered to be due to a disk herniation, I think treatment has shown the most satisfactory change. From being a most prolonged and distressing disability this condition now yields eminently satisfactory and rapid results. I am accustomed to make the following statement to these patients: (i) The sciatic nerve is pressed on by a piece of gristle from the patient's spine. (ii) This is a "mechanical" condition, and the cause can be removed mechanically. (iii) Neither hope, rest, massage, electricity nor medicine can do more than deaden

TABLE IV.
Treatment Given in 135 Cases.

Treatment.	Number of Cases.
Operative: "laminectomy" (with fusion in seven cases) ..	49
Epidural injection and/or manipulation ..	14
Spinal support ..	15
Palliative (rest, reassurance, medicine, "massage" or no treatment) ..	57

the pain. (iv) Nature will absorb this gristle, but it may take eighteen months, even two years. (v) I know of three people, in several hundreds, who experienced sudden dramatic relief, unexpectedly. (vi) If a few doses of "A.P.C." or the like will allow full work and recreation, the patient should continue. (vii) If pain limits activity or rest, then operation will give speedy relief and allow rapid recovery. (viii) Operation accelerates natural recovery and gives comfort; it does not cure. (ix) Operation requires seven to ten days in hospital, and the patient will get out of bed on the third day. (x) After operation the patient can resume light work in a month, medium work in six weeks, heavy work in three months. (xi) If the patient decides against operation, he should keep to conservative methods unless increased severity forces him to change. I then tell him whether I think he should be operated on or not. If he is to undergo operation, arrangements are made for his admission to hospital in seven to ten days, during which time he rests at home, because these arrangements can always be cancelled if he rapidly recovers on his own.

There is another type of compressive sciatica due to a disk lesion in which backache has been a major feature and a very disabling one, or spondylolisthesis is present. Then I try to avoid operation, because I consider that it necessarily involves spinal fusion if the patient does medium or heavy work. In these cases I try the older methods of treatment first and will do so for as long as three weeks. If there has not been considerable improvement by then, with or without the use of spinal support, operation appears indicated. Of this group results in those cases which are due to degeneration of the fifth lumbar disk may be eminently satisfactory if the patients are treated by laminectomy and screw fixation of the apophyseal joints combined with cancellous bone fusion of the fifth lumbar vertebra to the sacrum (King, 1948).

In cases of compressive sciatica which develop during inflammatory processes, malignant conditions or fractures, the treatment is firstly the treatment of the provocative cause.

Criteria for laminectomy in cases of compressive sciatica are as follows: (i) Causes other than disk lesion not found by clinical or X-ray examination. (ii) Pain or muscle weakness preventing reasonable work or rest in spite of mild analgesics. (iii) Disability increasing or stationary. (iv) Disability preferably of less than three months' duration. (v) Economic necessity for speedy recovery.

In cases of irritative sciatica I find the treatment somewhat unsatisfactory, though this may indeed be an understatement. If the sciatica develops with some unstable condition of the lumbosacral junction, then treatment of the back condition by rest, physiotherapy, epidural injection, supports or analgesics may be fairly satisfactory. I

have used manipulation to a decreasing degree for fear of making an irritative sciatica, a compressive one, even though the latter is easier to treat. In one case I have seen a *cauda equina* lesion develop owing to massive retro-pulsion and am glad that I was not the manipulator. In cases of spondylitis and with old people adequate nutrition, rest, and short-wave or X-ray therapy may give relief. In one case the removal of prolapsing haemorrhoids cured sciatica which had not recurred three years after. I know of some women who were relieved by operations for the correction of uterine displacement when there was a tender ovary on one side or uterine prolapse. If one leg is three-quarters of an inch or more shorter than the other, the sciatic pain may go on adjustment of the length of the heels. There would appear to be a small group of cases due to nutritional defects, as some people do respond to the use of hydrochloric acid in the case of achlorhydria, the administration of B group vitamins, or the administration of calcium, vitamin D, vitamin B₁, and iron, in the common form of a compound tablet.

TABLE V.
Findings at 49 Operations.

Findings.	Number of Cases.
Herniation of disk	42
No herniation found	4
Spondylolisthesis	3
Side affected:	
Right	14
Left	28
Nerve affected:	
Fifth lumbar	5
First sacral	37

Operation for the Removal of a Herniated Disk.

I believe that operation for the removal of a herniated disk is now comparable to the removal of an acutely infected appendix. For some years now I have used only the interlaminar approach, removing the *Ligamentum flavum* on the affected side between the two laminae. This admits one directly to the back of the disk. The operation is easy—that is to say, it is easy once learnt. It is quick, in fact it takes no longer to perform than the anaesthetist usually takes to anaesthetize the patient and place him in the prone position in which I usually operate. It can be performed single-handed with the use of a self-retaining retractor. The essence is selection of cases, a knowledge of what is being attempted and the avoidance of haemorrhage. "Sleeping Pentothal" anaesthesia combined with local infiltration with procaine and adrenaline is quite satisfactory. Other positions may increase the interlaminar gap, such as a lateral position or what is called the "Mohammedan praying position", but I prefer the patient lying flat in the prone position. I have performed about a hundred of these operations now, so have some familiarity with the performance. But I will not present results of all these as the follow-up is not sufficiently extensive.

Removal of a Herniated Disk and Spinal Fusion.

There are probably no clear indications for fusion at the time of laminectomy. If there is a long history of recurrent disabling backache preceding sciatica, or if there is severe backache with the sciatica, involving the fifth lumbar disk in a person engaged in medium or heavy work, then I consider fusion. If only a lumbo-sacral fusion is required, then I use screw fixation of the apophyseal joints with graft of cancellous bone from the iliac bone on one side. If it is necessary to fuse the fourth lumbar vertebra besides the fifth to the sacrum, I use a screw fixation as above and also a spinal fusion plate, using vitallium appliances. These metallic appliances, by internal fixation, shorten the time in hospital, so that a spinal fusion keeps the patient in hospital for two to three weeks instead of the seven to ten days for a simple disk operation. After fusion no work

is done for six weeks, during which the patient is taught to move and hold his back without flexion, using his hip joints instead of the lumbar part of his spine for bending. He should be fit for medium duties in three months, whereas in three months the disk patient would ordinarily be fit for anything.

Results.

I have analysed only a consecutive series of 135 private cases and a consecutive series of cases in which the patients underwent operation at a public hospital in 1948-1949, over about twelve months or so. This restriction of the survey was due to the limited time I could devote to it. At least a year is necessary to permit even the most superficial assessment of results. In the series of cases reported there have been no deaths, nor have there been complications other than the fact that I have not performed a fusion at the time on three people in whom it was probably indicated. One man was a stonemason, and he developed backache and was able to carry on with a spinal support and some

TABLE VI.
Results from 54 Questionnaires Sent to Patients Treated by "Laminectomy"
(59 sent out).

Subjective improvement: 47 good, 7 partial, 0 unrelieved.
Change of occupation after operation: 4 compulsory, 7 precautionary.
Residual symptoms (back or leg): 32.
Required further treatment: 6 (3 supports, 1 fusion).
Returned to previous sports: 32.

modification of his work. Another man doing heavy manual work developed backache two and a half years after removal of a herniated disk. This has required use of a back support and modification of duties. A woman who developed bronchopneumonia a month after laminectomy, with some persistent pulmonary infection giving severe recurrent attacks of paroxysmal cough and raised temperature, has now had a spinal lumbo-sacral fusion. I think the excessive coughing interfered with the natural "recovery" of the lumbo-sacral disk.

While a tremendous amount remains to be learnt about the fundamental processes involved, there is a form of compressive sciatica due to disk herniation which I believe is well established. It responds dramatically and satisfactorily to operative treatment. There is minimal risk, with minimal inconvenience and, as far as I can see, in careful hands no complications. I have seen patients operated on by others who have had complications such as nerve palsies, persistent pain and severe disability. This variation occurs with any form of surgery, which is in its essence an individual matter. I believe the time is past when surgery or operative treatment is looked on as a last resort for the treatment of compressive sciatica. When I look back over the years and think of the time I wasted for patients and the imperfect results I obtained and the weeks, sometimes months, of doubt and disablement which I occasioned, hoping that some conservative means would relieve them and trying to avoid operation, I believe that I shall not revert to such methods. In selected cases operation is quick and easy and appears without risk or complication, it being always borne in mind that no major operative procedure is completely free from risks.

This paper would not be complete without mention of the cases in which a herniation is diagnosed and none found at operation. I believe that these represent cases in which the operator has not discovered the herniation, but it is present. For some years I used small wool pads in the epidural space to control bleeding and assist exposure. I know that passing a probe into the space to dislodge a nerve root from the top of the herniation is sufficient sometimes to rupture the herniation and displace the "sequestrum" in the extradural space out of sight. The slit in the back of the disk from which it came can be seen with care, and with careful probing the "sequestrum" can be retrieved, confirming the diagnosis. In this regard I must confess that once I operated on the wrong side, and when exploring the canal with a curved malleable probe

I suddenly withdrew a nucleus "sequestrum". This came from the opposite side of the disk. The man showed good immediate improvement but later had a small recurrence, probably from further protrusion of nuclear material, which fortunately soon settled with conservative treatment. Since that occasion I have taken the precaution of marking the buttock on the affected side.

Acknowledgements.

Finally, I must thank you for allowing me to speak for so long and I must also thank the members of the X-ray Department of the Royal Adelaide Hospital, who produced the photographs and the 50 slides I have used.

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DEATH UNDER ANÆSTHESIA: MR. J. G. BEANEY'S CASE.

By BRYAN GANDEVIA,
Melbourne.

SUCH persons are like the figures which are introduced in tragedies, for as they have the shape, and dress, and personal appearance of an actor, but are not actors, so also physicians are many in title but very few in reality.

—Hippocrates, "The Law".

THIS case is recorded because of its twofold interest: It is an early example of death under anæsthesia in this country occurring at a time when death was barely recognized as a complication of chloroform anæsthesia, and as yet another case in which the "egregious Dr. Beane" (Craig, 1950) (Figure I) found himself called upon to justify his management. Further, the ensuing controversy produced allegations of Beane's malpractice in an earlier case, allegations which ultimately led to the famous "lithotomy inquest" so delightfully recorded by Dr. Craig.

The Case.

Michael Barry, aged fourteen and a half years, an inmate of the Industrial Schools in St. Kilda Road, was admitted to the Melbourne Hospital on December 8, 1875, under the care of Mr. James George Beane, F.R.C.S. For the past three years and three months he had suffered from disease of the hip, for which he had been almost continuously under treatment, and usually confined to bed. All active disease had now ceased, but the leg was drawn up in such a position as to be useless to him; it was ankylosed, the ball and socket forming one bony mass. His general health was regarded as "delicate" (for an unspecified reason), but although not fat he was tolerably well nourished. Mr. Beane considered that without surgery he would be a cripple for life.

On the afternoon of December 13 the patient, appearing in good health and spirits, was submitted to a capital operation for ankylosis of the hip, no preliminary consultation with other members of the honorary staff being sought. Two and a half ounces of brandy were given immediately pre-operatively to offset the patient's "delicacy". Chloroform was administered on an ordinary wire

and flannel inhaler (Figure II) by Augustus Llewellyn, M.B. (Melbourne, 1873) (Figure III), the resident physician, who was accustomed to giving chloroform daily. The operation appears to have been an attempt to produce a false joint by extracapsular division of the femur, probably below the level of the trochanter. The operation took fifteen minutes, very little blood was lost (no vessel was tied), and the chloroform was apparently borne well. One to two minutes after the inhaler was removed and just after Mr. Beane had turned away to address the students, the patient went pale, made a gasping noise and ceased to breathe. A student stationed at the pulse by Dr. Llewellyn stated that the pulse stopped quite suddenly without previous irregularity, and at the same time as the above-mentioned symptoms occurred. Dr. Llewellyn was the first to observe the patient's rapid deterioration and he pulled the tongue forward. Mr. Beane, his attention drawn to the circumstances, immediately ordered brandy to be given orally as a restorative, and this was given from a white spout drinking cup by Trivett, the operating-room attendant. Meanwhile galvanism and artificial respiration were applied energetically and efficiently by Dr. Llewellyn. Intravenous administration of ammonia, a remedy recently introduced by Professor Halford for snake poisoning and collapse and enjoying considerable vogue, was given. However, all efforts to revive the patient proved unavailing.

An autopsy was performed by Dr. Llewellyn in the presence of Mr. Beane and other gentlemen.

The brain and membranes were much congested, with serous effusions at the base of the brain and its ventricles. The brain was softer than usual. The lungs were fairly healthy, with the exception of some old adhesions at the back of the right lung. The heart was pale, flabby and undergoing fatty degeneration. All the other organs were fairly healthy. Death was caused by the administration of the chloroform while the patient was in a state of fatty degeneration of the heart. This fatty degeneration could not be discovered and was not suspected in so young a subject.

So ran Dr. Llewellyn's deposition to the City Coroner, and the condition of the heart was confirmed by Mr. Beane and others present. No reference was made to the hip.

At the inquest the Coroner (Dr. Youl), in his remarks to the jury, considered that no blame could be attached to anyone, and that the chloroform was efficiently administered. Chloroform could cause death unexpectedly, while heart disease was not necessarily a contraindication to its use, as he himself had given it in such cases without evil consequences. Mr. Beane, however, had failed to call a consultation of the other honorary surgeons before operating, as required by the hospital rules, and his reason for not doing so—that the proposed operation was new and original and therefore unknown to his colleagues, who consequently might not agree to it—was the strongest reason for calling one. The jury brought in a verdict in conformity with these remarks, with a rider recommending that the hospital committee insist upon rigid adherence to the rule regarding consultations prior to operations.

In due course, Dr. Youl conveyed the jury's finding to the hospital, which took steps to avoid a repetition of such reprehensible neglect of accepted hospital procedure.

The Controversy.

Perhaps the matter might well have been allowed to rest there, a cause ascribed and honour satisfied. But Victoria was a young and virile colony and Melbourne one of "the large Australian cities where differences and dissensions seem lamentably common" (Osler, 1897). Surgeons wielded a pen with almost as much facility as a scalpel, and rarely was this more clearly demonstrated than in the controversy which followed the issue of *The Argus* two days after the inquest (December 17). A leading article was devoted to a scathing indictment of Mr. Beane, who, it was implied, got himself into scrapes through an overweening estimate of his own abilities and an uneasy craving for opportunities to display them. Mr. Beane was reminded of his remark made during the course of his campaign for election to the honorary staff, that the position of honorary surgeon was a proud one, in that it

enabled the surgeon to "widen his sphere of usefulness by the voluntary exercise of his skill and experience amongst those whom poverty and misfortune have compelled to seek refuge in the sick wards of a public hospital"; it was suggested that he should contract his sphere of usefulness again as soon as possible. Without the protection of pre-operative consultation "the patients are literally at the mercy of any gentleman with a knife in want of a morning's amusement", while "any enthusiastic surgeon with a genius for advertising himself might suddenly make up his mind

tion. In effect, there had been insufficient care taken in the administration of the chloroform—not that he wished for one moment to prejudice a young doctor who was unknown to him. Mr. Fisher also stated that a pale, flabby heart was commonly found in deaths from chloroform; on the other hand, fatty degeneration of the heart was so rare an event in a boy of fourteen years that he could not accept it as fact. A subsequent communication to the editor in reply to criticism of his charges piously concluded, "there is no evil that may not be productive of some good, and



FIGURE I.

J. G. Beaney, circa 1875. According to the late Mr. Basil Kilvington he rarely removed the diamond rings before operating. From the original in the Melbourne Public Library.

to take a patient's head half off, for the purpose of attempting its replacement", and then claim the result as a triumph of conservative surgery. *The Argus* also could not agree that the operation was either new or Mr. Beaney's own. Finally, attention was drawn to the fact that Dr. Llewellyn was scarcely the proper person to perform the autopsy, although, of course, his honesty was beyond question, and his findings were confirmed by others present.

Next day a letter appeared from Mr. Alexander Fisher, F.R.C.S., a friend of Mr. Beaney, who wrote primarily to correct an erroneous reference to himself in *The Argus* report of the inquest. However, as he happened to be present at the operation, he now felt impelled to describe what took place. He observed that the chloroform inhaler was kept constantly applied to the patient's face throughout the operation, and that Dr. Llewellyn appeared more intent on watching the latter than in attending to his patient. When the boy's breathing became laboured at the end of the operation, Dr. Llewellyn, much to his surprise, kept trying to pour water down the patient's throat. Mr. Beaney, his attention being drawn to the fact that something was amiss, instantly ordered galvanism and artificial respira-

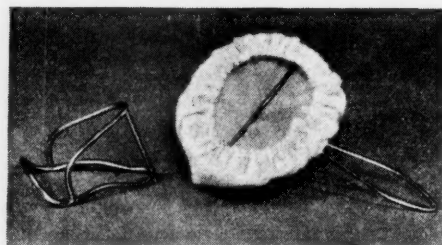


FIGURE II.

Murray's inhaler (left) and Skinner's collapsible inhaler, both of which were in common use in Melbourne by 1870. (By courtesy of Dr. Geoffrey Kaye.)

I hope and trust, Sir, that the good in this instance will be a great and substantial improvement in the management of the Melbourne Hospital".

It can be seen that the opening broadsides lacked nothing in force even when the aim was uncertain, and thereafter the battle raged fiercely, *The Argus* publishing nearly 20 letters claiming some relevance. It would be tedious to follow the various arguments in detail to the time when they were pushed into the background by events of greater moment. However, there is little doubt that the account of the circumstances of Michael Barry's death given in the above case record is accurate; it is in accord with the great weight of evidence, and with the findings of a special subcommittee of the Melbourne Hospital Committee appointed at the request of Dr. Llewellyn to inquire into Mr. Fisher's charges. This committee considered the evidence of no less than seven doctors, one student and Trivett. They found that the inhaler was not constantly applied, that the administration was skilful, that Dr. Llewellyn was not watching the operation (as from his position and the number of persons around the patient, including "non-professional persons in the arena", he had not the opportunity of so doing), and that brandy and water were poured down the patient's throat by the operating-room porter by direction of Mr. Beaney. During the course of the inquiry Mr. J. Wilkins, F.R.C.S., honorary surgeon to the Melbourne Self-supporting Infirmary for Diseases of the Chest, Throat, Eye and Ear, who had stated at the inquest that no greater pains could have been taken, was forced to admit that actually he had remarked to his neighbour, as the water was being given, that any surgeon who would act so should have seven years; he had not ventured this statement in the Coroner's Court, as in his opinion the child was already dead and the measures taken were otherwise appropriate. At no stage of the enquiry or newspaper correspondence did Mr. Fisher find any support for his accusations against Dr. Llewellyn, or for his veiled suggestion that death was due to asphyxia.

Mr. Beaney's reply to the editorial criticism was brief, and it referred only to the question of the originality of the operation. He claimed to have first performed it in 1871, and to have reported three cases in the *Australian Medical and Surgical Review* in November, 1873. In support of his claim he quoted from Sir William Fergusson's "System of Practical Surgery" (1870) to indicate that the operation was generally considered scarcely feasible or advisable. Another correspondent, "Coxa", promptly replied

that "Mr. Beaney's claims to original surgery are about as well-established as are those of his military services in the Crimea", and proceeded to quote, among other authorities, a subsequent passage from the same book describing attempts at the operation dating from days before Mr. Beaney was born. There seems to be no doubt that Mr. Beaney's idea of dividing the femur outside the joint capsule in the hope of producing a false joint had formed the basis of previous operations for "bony anchylosis", although to describe it as obsolete rather than original is perhaps excessively harsh.

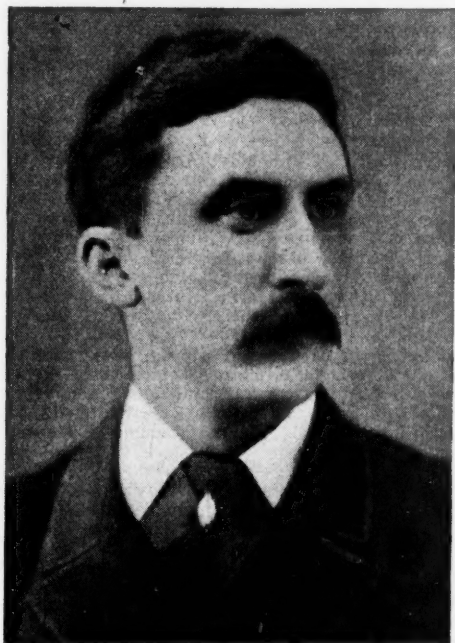


FIGURE III.

Augustus John Richard Llewellyn, who was among the first ten graduates of the Melbourne School. (From the original in the Department of Pathology.)

However, a more serious issue was introduced by a gentleman whose identity was never revealed, despite the fact that a body was exhumed and an inquest held as a result of his anonymous allegations. "A Practical Surgeon", after demolishing Mr. Beaney's claim to priority in the matter of the operation, continued: "Now as Mr. Beaney is so anxious to have his operations brought before the public, perhaps it would not be out of place here to mention the particulars of two large, or what in surgery is called capital, operations he performed in the Melbourne Hospital about three weeks ago." There followed the description of two fatal cases, in which death occurred allegedly as the result of Mr. Beaney's very poor operative technique. "Sir", ended a later epistle, "I sincerely trust, for humanity's sake, that two such operations may never again be performed." The Crown Law Department subsequently ordered an inquest to be held in one case, the lithotomy case, the story being recorded in detail in Dr. Craig's estimate of Mr. Beaney. The latter's immediate reply was to invite "A Practical Surgeon" to sign his contributions, and his letter concluded in characteristic full-blooded fashion:

Open be our fight, and bold each blow,
I steal no conquest.

One cannot help sympathizing with Mr. Beaney when, as the tide of battle turned against him, two laymen

entered the fray, anxious to have played some part in his final humiliation. One George Plant, of the Peacock Hotel, Northcote, recorded how Mr. Beaney operated on his child for ankylosis of the hip, how his (Mr. Beaney's) assistants washed their hands of the case, how he failed to visit the child for two days post-operatively, and how the child died after drinking the brandy he ordered on his arrival. Mr. Plant mentioned the names of the parents of children concerned in two similar cases, and indicated his regret that he had not disregarded the tender feelings of his family and insisted on an inquest at the time. Finally, Mr. Plant begged that *The Argus* insert his letter "in the interests of humanity". The other author signed himself "Corpus Sanum", and he stated that he had "no special prejudice against that eminent practitioner (Mr. Beaney) other than I may have acquired from seeing him once in full-dress in a ballroom [doubtless a reference to "Diamond Jim" Beaney's spectacular sartorial display], but I shudder at the description of his feats. . . . Of course the death of a patient is a comparatively unimportant incident in a perfectly complicated mangling of the human frame, but such incidents when of frequent occurrence may tend to alarm minds not soothed by an abstracted contemplation of surgical science". To these letters Mr. J. G. Beaney, 154 Collins Street East, could offer no effective counter, for their very publication had served their writers' ends. And doubtless by this time Mr. Beaney was closeted with the fiery Mr. Purves, elaborating his defence for the inquest on Robert Berth, the patient who had died of peritonitis after lithotomy.

One further letter is worthy of mention. J. Davies Thomas, M.D., F.R.C.S., formerly senior resident medical officer and chloroformist at University College Hospital, London, wrote from Adelaide to condemn the use of chloroform, suggesting ether as less dangerous. The Adelaide Hospital now used ether as a routine. He regarded a death rate of one in 8000 administrations of chloroform, mentioned at the inquest, as impossibly low, and considered the true figure to be nearer one in 2500. Incidentally, Dr. Youl's observation that he recalled only three previous cases of death under chloroform is surprising in view of the fact that Victoria had followed the British practice of using chloroform almost exclusively. However, several cases occurred in or around Melbourne in 1875, and at least one each in Adelaide and Launceston.

It still remains difficult to assess the precise position which James Beaney should occupy in the medical history of Melbourne. However, whenever he appears it is as the central figure, as something of a showman, if not an actor, "with a genius for advertising himself". It requires little imagination to picture him, one hand beneath his coat tails, a jewelled finger of the other to emphasize his words, speaking philosophically to the students of the unfortunate case:

For that must be our cure;
To be no more. Sad cure! For who would lose,
Though filled with pain, our intellectual being?
—"Paradise Lost."

Note.

The files of *The Argus* provided most of the information for this article, confirmed where possible by reference to *The Age* and the minutes of the Melbourne Hospital Committee meetings. Melbourne files of the *Australasian Medical and Surgical Review* are incomplete, so that Mr. Beaney's own article on the surgery of the hip could not be consulted.

I am grateful to Professor K. Russell for his comments on the typescript.

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ACUTE EPIDEMIC HÆMORRHAGIC FEVER.

By DONALD D. BEARD,
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Medical Corps.

In every war some disease or other has caused trouble and bewilderment to the medical corps. In the past, in various theatres there have been smallpox, plague, cholera, typhus, malaria *et cetera*. The latest in the Korean campaign is a disabling little-known fever which so far has been labelled "acute epidemic hæmorrhagic fever"; when something more is learnt of it the name may be changed. It first appeared with a number of cases in early summer of 1951; then the incidence fell off during the period from July to September, only to increase in October and November, when about 15 cases a week were occurring. Up till that time approximately 200 cases had been reported in the United Nations forces with 12% to 14% fatalities, and many of the other patients were seriously ill.

Report of a Case.

Private R.S., an Australian on leave from Korea, was admitted on November 4, 1951, to the Australian Camp Hospital in Tokyo complaining of anorexia, nausea and occasional vomiting and mild diarrhoea of two days' duration, thought by the patient to be due to excessive indulgence in alcohol during the first two days of his leave.

On examination of the patient his temperature was found to be 99.8° F., his pulse rate was 84 per minute and his respirations numbered 20 per minute. His face and neck were flushed, his eyes were "bloodshot" and his tongue and skin were dry. No abnormality was detected in the heart and lungs. His abdomen was tense and slight generalized tenderness was present. The limb reflexes were equal and active and no neck rigidity was present. The urine contained albumin ("++").

The patient was put to bed and given a fluid diet, with no treatment other than codeine sedation for the night. On the next day, November 5, his condition had deteriorated; his temperature was up to 100.6° F. and he complained of frontal headache, sore eyes and somewhat blurred vision, backache and persistent vomiting. The diarrhoea had stopped. No further abnormality was found except epigastric tenderness.

On November 6 subconjunctival hæmorrhage was present, minute red spots were visible in the patient's flushed face, the temperature was 103.8° F., and more albumin was detected in the urine ("+++"). The patient complained of further blurring of vision, backache and hiccup. The diagnosis of hæmorrhagic fever was made, and the patient was transferred to the United States 361st (Medical) Hospital, Tokyo. Here laboratory investigations gave the following information. The erythrocytes numbered 5,500,000 per cubic millimetre of blood and the leucocytes 22,800 per cubic millimetre, 66% being neutrophile cells. The bleeding time was 1.5 minutes and the coagulation time was six minutes. The specific gravity of the urine was 1010, and the urine contained albumin ("+++") and blood ("++"); the urea nitrogen content was 48 milligrammes *per centum* and the non-protein nitrogen content was 86 milligrammes *per centum*. Microscopic examination of the urine showed the centrifuged deposit to be crowded with red cells and an occasional finely granular cast was present.

On November 8 the patient became grossly irrational, confused and disorientated. He insisted on getting out of bed and trying to get out of the window, and asked for his clothes so that he could return to Korea to prevent his being posted a deserter. By November 12 his temperature had fallen to normal, but there was little change in his general condition, and the laboratory findings were as follows. The specific gravity of the urine was 1007, and the urine contained much albumin ("++++") and some blood ("++"); the non-protein nitrogen content was 107 milligrammes *per centum*.

On November 15 considerable improvement was apparent in the patient's condition, with fading of the rash and the subconjunctival hæmorrhage, diuresis, and a mental change to complete cooperation, orientation and lethargy. The laboratory findings were as follows. The specific gravity of the urine was 1005 and the urine contained some albumin ("++"); blood was absent, and the non-protein nitrogen content was 136 milligrammes *per centum*. Blood examination showed that the erythrocytes numbered 4,530,000 per cubic millimetre

and the leucocytes 8900 per cubic millimetre. It is noteworthy that although the patient's general condition had improved, his temperature had remained normal, blood had disappeared from his urine, the amount of albumin in the urine had fallen to "+" and the number of leucocytes had fallen to 8900 per cubic millimetre of blood, the specific gravity of the urine remained low and the non-protein nitrogen content had further risen.

On November 17 the patient was returned to the medical ward from the psychiatric ward. He had lost his lethargy, regained his appetite and begun to pass large quantities of urine. However, the non-protein nitrogen content of the urine remained at 129 milligrammes *per centum*. By November 19 further improvement had occurred, and the non-protein nitrogen content of his urine had fallen to 69 milligrammes *per centum* and the urea nitrogen content to 45 milligrammes *per centum*.

On November 30 he was discharged from hospital with frequency of micturition, the only residual symptom.

Description of the Disease.

Investigations carried out by Colonel Hornisher and the staff of the 121st American Evacuation Hospital, Korea, by Major Swift, of the 361st American Army Hospital, Tokyo, the 406th American General Laboratory, Tokyo, and by the United States Department of Preventive Medicine, Japan, have brought the following conclusions. The disease resembles one which first appeared in 1939 amongst personnel of the Imperial Japanese Kwantung Army in north Manchuria and which was known by various names, such as Songo fever, Kokka disease and Korin fever. In 1942 it was officially named by the Japanese Army Medical Corps "*ryukosei shukketsu netsu*" ("epidemic hæmorrhagic fever"). It is now established by Ibuki that since 1935 numerous epidemics of fever among Japanese troops stationed in Manchuria and reported as "hæmorrhagic purpura", "atypical scarlet fever", "typhus" *et cetera*, were actually epidemic hæmorrhagic fever.

Ætiology.

Kitano and the Japanese workers showed the cause to be a filterable virus, and no immunological relationship has been established between this and any other virus disease. It is probably transmitted to man (and very likely to horses) by the mite *Laelaps Jettmari Vitzthum*, the host for which is the field mouse *Aponomus agrarius*.

Epidemiology.

Infection occurs when the virus passes from the salivary gland of the mite during the biting process, of which the victim is often unconscious, and no bite marks are found as in scrub typhus. The mites are not engorged with lymph and there is no evidence of blood sucking. The mite retains the virus throughout its life cycle.

The peak periods of May, June and October and November coincide with the periods during which most rapid multiplication of the mite takes place, the most severe cases occurring in the autumn. However, cases have occurred during all other months. Person-to-person infection probably does not occur, as so far no cases have been reported in hospitals in Japan where the patients have been treated.

Distribution.

Up to 1951, reports of the disease had come only from Manchuria; but since the rodent *Aponomus agrarius* occurs throughout Korea, it is not surprising that cases are now occurring there, the infection probably being brought down by members of the Chinese Army. It is especially prevalent in areas along river banks and in swampy marshlands where the grass grows high and is unattended—conditions which are found near the present battle line on the Imjin River, where many rice crops are unharvested.

Pathology.

The outstanding feature is a pronounced disturbance of the peripheral circulation, with paralysis of the capillaries causing stasis and transudation and later spreading to larger vessels. This becomes apparent in the skin and visible mucous membranes, and post-mortem examination shows many organs to be affected. The hæmorrhagic tendency differs in extent with the individual case, but

the areas of involvement are specific for the organ concerned—for example, the right atrium of the heart, the subcapsular surface of the liver, the reticular zone of the adrenal, the outer area of the medulla and the surface of the cortex of the kidneys, and the ciliary body of the eye. Diffuse oedema of the organs is due to the circulatory disturbances and varies with each organ.

The Kidney.—Swelling may double the normal weight of the kidney and rupture from severe hæmorrhage may be found. The cut surface of the cortex is dull and cloudy in contrast to the vivid red of the medulla, so that a line of demarcation is produced which is characteristic of the disease. All the capillaries and loops of the Malpighian corpuscles are flooded with blood, while the interstitial tissue is oedematous.

The Heart.—Examination of the heart reveals albuminous hyaline or waxy degeneration. The circulatory disturbance causes dilatation, particularly in the right auricle.

The Liver.—In the liver swelling is less than in the kidney. Examination of the cells reveals, albuminous degeneration and the chordæ undergo necrosis.

The Spleen.—In the spleen vascular changes cause similar alterations to those which occur in the liver, and reactive hyperplasia of the reticulo-endothelial system is found.

The Lungs.—Flooding of the alveoli may give rise to respiratory distress, and later pneumonic changes appear. Small hæmorrhages also appear in the interstitial tissue.

The Brain.—In the brain circulatory disturbances are most pronounced in the capillaries of the membrane and parenchyma. A slight degree of cloudy degeneration is found in the nerve cells.

Signs and Symptoms.

The case reported in this paper followed the usual pattern. After an incubation period of fourteen to twenty-one days, a short prodromal stage includes malaise, anorexia, nausea and limb pains. Then the temperature rises rapidly within two or three days to 103° to 105° F., where it remains for three to five days; it then falls quickly to normal or subnormal, usually by rapid lysis. During the acute stage, while the temperature is elevated, the following signs and symptoms are present: severe headache, hiccup, epigastric pain, vomiting, sore eyes with blurred vision, mild dyspnoea, myalgia, low backache, and the signs of capillary disturbance—petechiæ of the skin, particularly of the face and the upper part of the trunk, hæmorrhage from the gums, epistaxis, melæna and hæmaturia. There is a peculiar odour about the patient, and his tongue has a dry yellow coating. Oliguria is present from the start. Within two to five days of the fall in temperature, the condition of the majority of patients begins to improve, good signs being diuresis and the regaining of appetite. Convalescence may be lengthy, up to four to six weeks elapsing before complete recovery and the loss of frequency of micturition, which is probably the most persistent symptom.

Laboratory Findings.

During the prodromal stage examination of the blood reveals a slightly lowered leucocyte count and a slightly raised erythrocyte count. The urine contains albumin and the non-protein nitrogen content is normal or slightly raised.

During the acute stage the leucocyte count is considerably raised, to as much as 50,000 cells per cubic millimetre. The polymorphonuclear leucocytes show a "shift to the left". The urine contains a heavy cloud of albumin, blood (often in macroscopic amounts), and casts (all types may appear); the non-protein nitrogen content is often raised to 100 milligrammes *per centum*, and the specific gravity of the urine is 1005 to 1010.

During the afebrile stage, after the fall in temperature improvement frequently does not occur for several days; in fact, the patient's condition may grow worse, and delirium, further hæmorrhage and a rise in the non-protein nitrogen content of the urine, sometimes to 200 milli-

grammes *per centum*, may occur. Improvement brings a fall in the number of leucocytes, a fall in the amounts of non-protein nitrogen and albumin in the urine, disappearance of casts and an increase in the specific gravity.

Prognosis.

Bad prognostic signs are early bradycardia and hypotension, persistent hiccup, hæmoptysis and signs of cerebral hæmorrhage, the last-mentioned being nearly always fatal.

Treatment.

To date no specific treatment has been evolved. All antibiotics have been used without benefit. The most effective measures have been the following: (i) a transfusion of 200 to 500 millilitres of convalescent blood (taken on the fourteenth to the twenty-first day of illness and given if possible before the fifth day); (ii) early dehydration of the patient; (iii) sedation with barbiturates; (iv) the administration of 50 milligrammes of vitamin K and 200 milligrammes of vitamin C daily; (v) the administration of oxygen for respiratory distress.

Conclusion.

Acute epidemic hæmorrhagic fever is probably a mite-borne virus disease, which has been recognized in Manchuria since 1936, but which appeared in Korea in the summer of 1951. The mortality rate is approximately 12% to 14%. No treatment is specific.

Acknowledgements.

I wish to thank Major-General F. Kingsley Norris, C.B.E., D.S.O., E.D., Director-General of Medical Services, and Brigadier C. W. Nye, E.D., Deputy Director of Medical Services, British Commonwealth Forces in Korea, for permission to publish this paper. My thanks are also due to the staffs of the American 361st and 121st Hospitals, the 406th General Laboratory and the Department of Preventive Medicine, for access to laboratory investigations.

Reports of Cases.

PNEUMOCOCCAL MENINGITIS TREATED WITHOUT INTRATHECAL CHEMOTHERAPY.

By R. I. MEYERS,

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Clinical Record.

BABY A.J.R., aged two and a half months, weighing thirteen pounds two ounces, was first examined by his private practitioner, who, referring him to hospital, wrote:

He became ill last night with a high temperature and has refused his feeds since then; his breathing has been rapid and he has been crying intermittently, but he has had no sudden screaming.

O.E.—T. 102.4. He is pale with a tired expression and tendency to deviate the eyes to the right and a suggestion of nystagmus. The fontanelle feels tense. No photophobia. No head retraction. No adventitious sounds could be heard in the chest and percussion note was normal. Abdominal examination revealed nothing of note. Membrana tympani: N.A.D.

The doctor suspected meningitis.

The patient was the younger of a family of two. The parents were healthy and the sibling was well. The patient's birth weight was ten pounds seven ounces. Delivery had been "instrumental and difficult". His progress had been uneventful and he was fed at the breast and with immediate complements of modified cow's milk.

Examination of the baby on his admission to hospital several hours after he had been examined by his doctor

confirmed the latter's observations. There was no neck stiffness. Lumbar puncture revealed cloudy fluid which contained 750 cells per millilitre (mostly polymorphonuclear leucocytes), Gram-positive diplococci resembling pneumococci, no sugar, 800 milligrammes of protein *per centum* and 730 milligrammes of chlorides *per centum*.

The following chemotherapy was begun at once: intramuscular injections of crystalline penicillin (250,000 units every two hours), and sulphadiazine (five grains) and sodium citrate given by mouth every four hours.

On the second day the following changes were noted: (i) slight neck stiffness, (ii) dry tongue and lips, (iii) a haemoglobin value of 45%. Accordingly, N/5 saline with 4% glucose solution was administered intravenously at the rate of eight to ten drops per minute from 10 p.m. to 4 p.m. the next day (a total of 450 millilitres), and was followed by 140 millilitres of blood at a rate of four to eight drops per minute.

On the third day the anaemia had been largely overcome (haemoglobin value 85%) and the urinary output was satisfactory.

By the fifth day neck stiffness had disappeared, the fontanelle was soft and the temperature was normal.

The patient thereafter continued to make an uneventful recovery, receiving chemotherapy as indicated in Figure I.

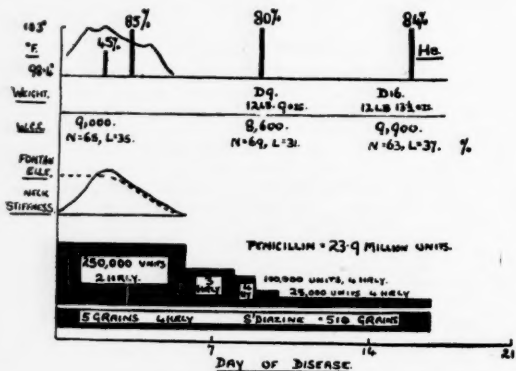


FIGURE I.

the total amounts being as follows: penicillin, 23,900,000 units; sulphadiazine, 510 grains. Feeding was, in brief, as follows. On the second and third days oral glucose-saline solution (average 30 ounces) was given by mouth. On the fourth and fifth days he received his own milk¹ and glucose-saline solution (average 30 ounces). From the sixth day onwards he received his own milk (average 35 ounces).

The patient was discharged from hospital, well, on the twenty-third day, and inquiry some ten months later revealed that the child was in good health.

Comment.

Should intrathecal therapy be used in pneumococcal meningitis?

There are two divergent views, the one advocating no intrathecal therapy on the grounds that later permanent brain damage may result, and the other advocating its use on the grounds that penicillin given intrathecally is necessary if treatment is to be successful (Applebaum *et alii*, 1949; Joseph, 1949; Robbie, 1949; Barnet, 1948). Cases are reported both of death despite intrathecal therapy, and of progression of meningitis until penicillin was administered intrathecally. In many of the cases in the latter category the intramuscular dose of penicillin employed was

¹ The term "own milk" means the patient's mother's sterilized expressed breast milk. It was given at half-strength for approximately one week and then gradually increased to full strength.

much smaller than that advocated today, but not in all; for example: "Dowling has claimed that when I.M. injections of the order of one million units are given every two hours curative amounts of penicillin are present in the cerebrospinal fluid. We have not been able to confirm this" (Smith, 1950).

What line of treatment should be adopted in areas where only limited facilities are available for laboratory procedures and for sterilization of instruments?

Provided Benedict's reagent is available, the diagnosis of meningitis may be verified within ten minutes of performance of the lumbar puncture, and if a microscope, counting chamber, stains and sufficient time are available, the pneumococci may be found; but of course this is not always feasible.

If an autoclave is not available, then, irrespective of one's opinion with regard to the intrathecal use of penicillin, it may be considered justifiable, one diagnostic lumbar puncture having been performed under the most aseptic conditions that can be obtained in the circumstances, not to perform lumbar puncture again, especially not to instil intrathecally any materials which may not be pure.

Sulphadiazine given by mouth, penicillin given intramuscularly, and any necessary restorative therapy could be instituted without delay and without danger.

Acknowledgements.

My thanks are due to the Sisters of Mercy, Mater Misericordiae Hospitals, Brisbane, for permission to publish this report and to Dr. P. A. Earnshaw, senior honorary physician, Mater Misericordiae Children's Hospital, for permission to use case notes and for encouragement and advice; to Dr. K. B. Fraser, honorary consultant surgeon, and Dr. L. S. Davies, senior honorary surgeon, for permission to use case notes; and to Miss M. Blakeway, librarian, University of Queensland Medical School, for help with references.

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Addendum.

Since the completion of the report of the foregoing case, two further cases have occurred of pneumococcal meningitis cured (without intrathecal therapy) by the intramuscular injection of penicillin and the oral administration of sulphadiazine in doses comparable to those indicated. A summary of the relevant facts is appended, and it is of interest to note that neither patient had previously been healthy.

Baby S.J.W., a female, aged one year and nine months, had undergone X-ray therapy for Hand-Schüller-Christian cranial lesions. Two days later, drowsiness, neck stiffness and pyrexia developed. An upper respiratory tract infection had been present ten days beforehand. The cerebro-spinal fluid contained 1200 cells per millilitre (mainly polymorphonuclear leucocytes), a few Gram-positive diplococci resembling pneumococci, a normal amount of sugar, and 200 milligrammes of protein *per centum*. Neck stiffness was absent and the temperature was normal after forty-eight hours. The patient had to be tube-fed for the first twenty-four hours.

Baby P.N.M., a male, aged two years and four months, had had languor for two days, sore throat and photophobia

for one day, and two convulsions on the night of his admission to hospital. Neck stiffness was pronounced and the tonsils were inflamed. He had had "pancreas trouble" as a baby. The cerebro-spinal fluid contained 900 cells per millilitre (mainly polymorphonuclear leucocytes), many Gram-positive cocci resembling pneumococci, no sugar, and 200 milligrammes of protein *per centum*. By the fourth day neck stiffness was absent and the temperature was normal. On the fifth day a transient right facial paresis was noted. In this case progress was followed by five lumbar punctures. A cough was persistently present, and treatment for the pancreatic fibrosis was continued.

Reviews.

EMERGENCIES IN PÆDIATRICS.

ADOLPH DESANCTIS and CHARLES VARGA have incorporated in a "Handbook of Pediatric Emergencies" a large and varied number of medical conditions and their immediate treatment.¹

This book has been designed for members of the resident staff and physicians enrolled in courses offered by the Pediatric Department of the Post-graduate Medical School at the New York University, Bellevue Medical Centre. It is set out in chapters for the various bodily systems—cardio-vascular, gastro-intestinal, genito-urinary, neurological, and respiratory. The sections on *asphyxia neonatorum* and resuscitation of the new-born are especially good.

In addition there is a long section on poisons with a lengthy appendix setting out the concise and reasoned action to be followed.

The chapter on the care of the premature infant is dogmatic but useful.

Finally there is a section, which is profusely illustrated, on paediatric procedures. This is excellently done and immensely practical.

In all, the book is concise, dogmatic and up to date, and could not fail to be of use to all who deal with children.

THE TREATMENT OF VARICOSE VEINS.

In the preface to his excellent book "The Treatment of Varicose Veins and their Complications", Dr. Stanley Rivlin describes it as "This little monograph".² This should be remembered, for there is a great deal about varicose veins that has been omitted. What has been included is very much to the point. The author leaves out all frills and gets down to fundamental principles of diagnosis and clarifies the corresponding principles of treatment. The book offers a straightforward approach to the problem and clearly outlines the steps that must be followed for successful management of varicose veins.

A classification is made based on the work of Clarkson, whose article published in *The Lancet* in 1938 is rightly praised. The subjects of classification and examination are very well illustrated and have many diagrams to make the points clear; in fact there are more pages of diagrams than of reading matter.

The Trendelenburg test, with the times of filling of the veins, may seem somewhat complicated, unorthodox and arbitrary. However, the principles are sound and correct, and actual times have been substituted for the usual descriptions of "quickly", "slowly", "immediately" *et cetera*.

The principles of treatment are clearly set out and there are further diagrams, including some showing recurrences after indifferent treatment by injection or operation. The operation of juxta-femoral ligation is so described that criticism might be levelled at it on the grounds of oversimplification. Sufficient stress is not laid on the difficulties and possible mishaps, and it is unwise to describe deep vein thrombosis as a "bogy". However, sound advice is given.

¹ "Handbook of Pediatric Medical Emergencies", by Adolph G. DeSanctis, M.D., and Charles Varga, M.D.; 1951. St. Louis: The C. V. Mosby Company. Melbourne: W. Ramsay (Surgical) Proprietary, Limited. 8½" x 5½", pp. 284, with 51 illustrations. Price: £2 12s. 6d.

² "The Treatment of Varicose Veins and Their Complications", by Stanley Rivlin, M.R.C.S., L.R.C.P.; 1951. London: William Heinemann (Medical Books), Limited. 7½" x 5", pp. 64, with five plates and 25 text figures. Price: 10s. 6d.

as to how to avoid this condition. In the section on complications emphasis is laid on the efficacy of the proven and simple method of compression. This is a basic principle in treatment and it is well that it should be described in detail.

This book is easily read, clearly printed and well filled with illustrations and diagrams. Its value depends on its clear, simple statement of the essentials that must be followed for success in dealing with varicose veins and their complications. This book was awarded the Hunterian Gold Medal.

AN ATLAS OF ANATOMY.

THE third edition of "An Atlas of Anatomy" by J. C. Boileau Grant will be as well received as its predecessors.¹

There has been an increase in the size of the book, with an addition of 70 new illustrations, whilst a revision of 23 of the older figures, to some of which colour has been added, is an improvement. The style is the same as in previous editions, and all figures are of actual dissections. Injection plastic moulds of such items as the pancreatic ducts introduce a new note, as does the inclusion of the details of the bronchial tree and the broncho-pulmonary segments. Common variations and anomalies are scattered throughout, but we doubt the value to the student of such detail as is evident in the region of the bile ducts, whilst the inclusion of such structures as suprasternal ossicles and the types of supra-trochlear foramina is a doubtful asset.

A brief note on morphology might assist in the interpretation of such things as the sternalis muscle in Figure 17b. There is a very occasional slip in terminology, although the reference to the pectineal part of the inguinal ligament as the lacunar ligament is time-honoured and customary. Possibly a schematic diagram would assist in the interpretation of the external *sphincter ani*. One of the highlights is in the number of the communicating veins running from the saphenous to the deep system in Figures 225 and 226.

There is no doubt that this book can be safely recommended as a reliable atlas in anatomy.

A COLOUR ATLAS OF PATHOLOGY.

A MAGNIFICENT colour atlas of pathology has been prepared under the auspices of the United States Naval Medical School of the National Naval Medical Center, Bethesda, Maryland.² The material for the subject matter of the plates came from the rich stores in the Pathology Department of the United States Navy, in its Army's Institute of Pathology, in the Johns Hopkins Hospital and in the Georgetown University Medical School. Dr. Charles F. Geschickter and Captain Paul Wilson, medical officer in command of the Medical School, were the initiators of the project. Commander W. W. Ayres, of the Medical Corps, shared with Dr. Geschickter the burden of the undertaking. One of the most important objects aimed at was the correlation of the pathological processes illustrated with the clinical histories. This has been done in the following way. A concise description of the pathology of a particular system is first given. For example, that of "Diseases of the Hematopoietic System" occupies six pages, that of the "Musculoskeletal" twenty-four. Then follow plates illustrating this pathology accompanied by clinical notes of the cases and descriptions of the sections or the specimens used in these illustrations. The result is that the 1053 figures in colour cover a wide range of disease conditions and include some that are likely to be seen in Australia only as introductions, having been contracted elsewhere. In this work the pathologist has an excellent illustration and a case history of some of such exotic diseases or other rarities that he can consult, if in doubt as to his diag-

¹ "An Atlas of Anatomy", by J. C. Boileau Grant, M.C., M.B., Ch.B., F.R.C.S. (Edinburgh); Third Edition: 1951. Baltimore: The Williams and Wilkins Company. Sydney: Angus and Robertson, Limited. 11½" x 9", with 637 illustrations, many in colour. Price: £6 9s.

² "Color Atlas of Pathology: Hematopoietic System, Reticulo-Endothelial System, Respiratory Tract, Cardiovascular System, Liver, Elementary Tract, Kidney and Urinary Tract, Musculoskeletal System", prepared under the auspices of the U.S. Naval Medical School of the National Naval Medical Center, Bethesda, Maryland: 1951. Philadelphia: J. B. Lippincott Company. Sydney: Angus and Robertson, Limited. 10" x 7½", pp. 558, with 1053 illustrations. Price: £10 9s.

nosis of such. The illustrations, particularly those of micro-sections, are excellent and faithfully portray what is to be seen. To give an idea of the general scope of some of the less common lesions which are portrayed the following may be mentioned: the lung in drowning, lipid pneumonia, blast injury, tularæmia, thalassanæmia (Mediterranean anæmia), sickle-cell anæmia, *periarteritis nodosa*, giant follicular lymphoma, thymoma, histoplasmosis, rhinoscleroma, "rhabdomyoma" of the heart, conditions of the teeth, gums and tongue (32 illustrations), blood films (24 superb plates), regional ileitis and dermatomyositis. There is a good index of twenty-four pages. This volume is very well produced and reflects great credit on all concerned. It is a valuable book of reference to the pathologist, particularly in its citing of individual cases, and the clinician will find in its pages a description of the pathology with illustrations of the conditions that he or the pathologist has diagnosed. We have pleasure in recommending it.

THE SCIENCE OF LOUIS PASTEUR.

A LEADING bacteriologist attached to the Rockefeller Institute in the United States of America set himself a most responsible, exacting and laborious task when he undertook the writing of a critical and detailed account of the monumental scientific studies which occupied one of the world's greatest exponents of the experimental method for nearly half a century. Dr. René J. Dubos, an experimentalist of no mean order in his special department of medicine, would seem to be ideally fitted to undertake the authorship of this book "Louis Pasteur: Free Lance of Science",¹ as he was born and educated in France; such qualifications would enable him to give a reasonable evaluation of Pasteur's work from the modern scientific point of view, and he should be in a position to appreciate the Gallic temperament.

It is obvious that much careful preparation has gone into the compilation of material for the book: that an intensive study has been made of the collected writings of the great scientist, and of the excellent biographies published by some of his immediate associates early in this century. Furthermore, Dr. Dubos has spared no pains to give his readers a broader outlook on the chemical and biological knowledge of the period. He has achieved his purpose in a philosophical sense by full commentaries on and expositions of the contemporary scientific theories and opinions in currency while Pasteur's remarkable discoveries were beginning to have their impact on many aspects of French national life. Hence most research workers in this field of scientific investigation should find encouragement in the chapters dealing with the laboratory studies.

On the other hand, there are a few readers who will be sadly disappointed if they expect to find here an inspired biography of the French scientist in his real setting among the people from whom he derived his humble and genteel origin. The three opening chapters are something in the nature of a synoptic introduction which seems to end in an anticlimax; the writer seeks to stir the reader's imagination before he has unveiled the mystery and magic of Pasteur's incomparable scientific investigations. One passage alone reaches the mark and that is a quotation from the *London Spectator* of 1910, in which an English doctor, Stephen Paget, reveals his thoughts as he stands reverently before the tomb of the great master in that bejewelled little chapel beneath the Pasteur Institute in Paris:

Yet to me, who remember him, saw him, heard him talk, shook hands with him, all the adornments round his grave were not sufficient, and the half was not told me. For he was, it seems to me, the most perfect man who has ever entered the kingdom of Science . . . Here was a life, within the limits of humanity, well-nigh perfect. He worked incessantly; he went through poverty, bereavement, ill-health, opposition; he lived to see his doctrines current over all the world, his facts enthroned, his methods applied to a thousand affairs of manufacture and agriculture, his science put to practice by all doctors and surgeons, his name praised and blessed by mankind.

Those of us who long ago were privileged to share some of Stephen Paget's experiences are inclined to believe that an adequate biography of Louis Pasteur will never be written.

¹ "Louis Pasteur: Free Lance of Science", by René J. Dubos; 1951. London: Victor Gollancz, Limited. 9" x 5½", pp. 418. Price: 18s.

Books Received.

[The mention of a book in this column does not imply that no review will appear in a subsequent issue.]

"The Physician: As Man of Letters, Science and Action", by Thomas Kirkpatrick Monro, M.A., M.D., LL.D.; Second Edition; 1951. Edinburgh: E. and S. Livingstone, Limited. 9" x 6", pp. 268. Price: 21s.

Consists of biographical notes of medical men who have distinguished themselves in other ways than in the practice of medicine.

"Rosenau: Preventive Medicine and Hygiene", by Kenneth F. Maxcy, M.D., Dr.P.H.; Seventh Edition; 1951. New York: Appleton-Century-Crofts, Incorporated. 10" x 7", pp. 1478, with 49 illustrations and text figures.

The sixth edition was published by Rosenau in 1935; the present author has had the assistance of 26 collaborators.

"Human Kinetics and Analysing Body Movements", by T. McClurg Anderson, F.F.Ph.; 1951. London: William Heinemann (Medical Books), Limited. 9" x 6", pp. 298, with 238 text figures. Price: 30s.

This is an analysis of body movements in terms of skeletal mechanics and muscular action.

"Ophthalmic Nursing", by Maurice H. Whiting, O.B.E., M.A., M.B., B.Ch. (Cantab.), F.R.C.S., with an introduction by John Parsons, C.B.E., D.Sc., F.R.C.S., F.R.S.; Sixth Edition; 1951. London: J. and A. Churchill, Limited. 7½" x 5", pp. 148, with 56 illustrations. Price: 8s. 6d.

This book deals with the practice adopted at Moorfields Eye Hospital; the fifth edition appeared in 1948.

"The Health Services: Some of Their Practical Problems", with an introduction by Henry Lesser, C.B.E.; 1951. London: published for the Institute of Public Administration by George Allen and Unwin, Limited. 9" x 5½", pp. 136. Price: 10s. 6d.

Consists mainly of papers read at a conference organized by the Institute of Public Administration and held at Westminster in March, 1951.

"Clinical Hat Pegs for Students and Graduates", by R. J. Willan, C.B.E., M.V.O., V.R.D., M.S., F.R.C.S.; 1951. London: William Heinemann (Medical Books), Limited. 7½" x 5", pp. 126, with 29 text figures. Price: 12s. 6d.

A book of mnemonics.

"Any Questions?: A Selection of Questions and Answers Published in the British Medical Journal"; First Series; 1951. London: British Medical Association. 7½" x 5", pp. 252. Price: 7s. 6d.

Repeated requests for publication in book form of "Any Questions" in the *British Medical Journal* were received; this is the first selection to appear as a separate volume.

"The Urology of Childhood", by T. Twistington Higgins, O.B.E., M.B., Ch.B., F.R.C.S., D. Innes Williams, M.D., M.Chir., F.R.C.S., and D. F. Ellison Nash, F.R.C.S.; 1951. London: Butterworth and Company, Limited. 10" x 7", pp. 296, with 136 illustrations. Price: 64s.

Intended to be a practical guide to diagnosis and treatment.

"Recent Advances in Clinical Pathology", by various authors. General editor: S. C. Dyke, D.M. (Oxon.), F.R.C.P. (London). Section editors: Bacteriology, R. Cruickshank, M.D. (Aberdeen), F.R.C.P. (London); Biochemistry, E. N. Allott, D.M., B.Sc. (Oxon.), F.R.C.P. (London); Haematology, R. G. Macfarlane, M.D. (London); Histology, A. H. T. Robb-Smith, M.D. (London), M.R.C.P. (London); Second Edition; 1951. London: J. and A. Churchill, Limited. 8" x 5½", pp. 588, with 37 plates and 36 text figures. Price: 40s.

The first edition appeared in 1947; there are 32 contributors to this edition.

The Medical Journal of Australia

SATURDAY, MARCH 1, 1952.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

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CANCER RESEARCH.

If medical science is reproached with failure to solve the problem of cancer it is assuredly not open to the taunt of not having tried, for indeed the amount of research directed towards the origin and nature of this dread disease is enormous. All over the civilized world organized investigations are carried out in universities, hospitals and special institutes displaying an activity never before presented in the wide realm of pathology. Funds from governments, also donations and bequests, have flowed into such research in unprecedented volume. Just as war quickens inventive genius, so has the challenge of cancer stimulated thought and action wherever medical science is pursued. Every device in the most modern developments of the basic sciences has been borrowed and often improved upon; the electron microscope, radioactive isotopes, chromatography and X-ray diffraction have all been roped in for use in the quest. Recondite researches in organic chemistry, which, a generation ago, would have been labelled academic, are now vigorously conducted. As an example of this it might be mentioned that nearly five thousand publications on chemical carcinogenesis have been listed. That plant pathology might yield useful evidence is at last being seriously considered, witness the work carried out in Sheffield on crown gall tumour in the tomato; it was found that β indole-acetic acid facilitates the formation of the gall, whilst cortisone inhibits it. Then, too, clinical material on a vast scale has been sifted and critically examined. From time to time the results of these widespread investigations have been published after expert editing. The twenty-eighth annual report of the British Empire Cancer Campaign covering the year 1950 has recently appeared; also the forty-eighth annual report of the Imperial Cancer Research Fund (1950-1951). Special conferences have also been held; for example, one

under the joint auspices of the Chemical Society, the Royal Institute of Chemistry, the Society of Chemical Industry and the Institute of Petroleum studied "The Chemistry of Cell Division", really malignant growths. In November of last year there was published the report of the Medical Research Council in which the relation of cancer to the environment and particularly to tobacco smoking was discussed.

If the subject was not so grimly serious it would be almost amusing to note how opinions as to cause of malignant disease have swung from a virus hypothesis to a non-parasitical supposition. It was found, for example, that mouse tumours could be frozen and dried and yet remain capable of successful implantation into healthy mice. This suggested a virus, as living cells were regarded as incapable of resisting such treatment. Later work has demonstrated that freeze-drying, even if vigorously pursued, can yet leave viable cells, and so the virus hypothesis has in certain quarters been abruptly abandoned and may now be regarded as relegated, possibly for the time being only, to the background.

Cancer of the lung has increased alarmingly in recent years; it has attained something like four times the incidence in an interval of fifteen years. Improved methods of diagnosis, including bronchoscopy, cannot explain the phenomenon. The vogue of cigarette smoking came under suspicion and hopes ran high when it was discovered that American, British and Norwegian tobacco contains exceptionally high amounts of arsenic. But Turkish tobacco displays little arsenic on analysis and yet lung cancer is decidedly prevalent in Istanbul. If smoking was the cause or even a leading factor in causation, one would expect that women would give evidence of this reaction, but this is debatable. Another kindred problem is that whilst cancer of the larynx has increased, but not at the same rate as cancer of the lung, there is much more of this in men than in women. It has actually been suggested that the larynx is a secondary sex character in men just as the mammary gland is in women, and secondary sex organs seem to be particularly prone to malignant invasion. Despite the difficulties mentioned, there is no denying that tobacco smoking does appear to be related to the growing incidence of lung cancer. The report of the Medical Research Council is clear on this matter, pointing out that in an extended survey of over 700 cases of pulmonary cancer this group contained a much smaller proportion of non-smokers and a larger proportion of heavy smokers than other patients. Benzopyrene in motor-car exhaust gas and in town smoke has also fallen under suspicion, but again the evidence is not conclusive. The remarkably high incidence of primary liver cancer in South African Negroes has been shown to be very possibly related to the use of ragwort as a native remedy for all sorts of maladies. Liver tumours in rats have been experimentally produced by extracts of this plant. Much work, it may be noted, is being carried out on a possible action of pituitary gonadotropins especially in the presence of a carcinogen. The modern view that cancer is an aberration of four features of all life, growth, development, repair and differentiation, directs research more and more to the cell nucleus, and here the nucleo-proteins play an important part in nuclear metabolism as also in heredity.

Current Comment.

THE INVESTIGATION OF THE CAUSES OF ENCEPHALITIS.

LESLIE AFZELIUS-ALM has reported the result of an investigation into the aetiology of "aseptic encephalomeningitides" in Gothenburg over a period of eighteen years.¹ He has produced a careful and detailed analysis of clinical reports, with an attempt to assess the possible role of the viruses of herpes, influenza, mumps and lymphocytic choriomeningitis. Let us say at once that one patient yielded a specimen of the herpes virus, and that complement-fixation tests on paired sera showed the presence of mumps antibody and lymphocytic choriomeningitis antibody in a small proportion of cases, but the information cast no light on the aetiology of the group of conditions. One turns hopefully to the section on laboratory investigations of material obtained at autopsy and its treatment in the search for a virus. One outstanding fact leaps to the eye. No mention whatever is made of the technique of culture in the embryonated hen's egg, in which three routes of inoculation are available. Three laboratory animal species were inoculated, mice, guinea-pigs and rabbits, and on two occasions "transmissible agents" were obtained in mice and guinea-pigs and in one test with serum from a convalescent patient and an antigen prepared from this agent, complement was fixed. Owing to a laboratory accident to a refrigerator all this material was lost, and no neutralization tests had been carried out. The author apparently did not attach any profound importance to this loss, since he remarks that the "failure" to isolate virus from autopsy material may be due to the length of illness of the patient and states that success is unlikely to be achieved when the disease has been in existence for more than one week; he also canvasses the idea that the morbid process may be a sequela of bacterial infection. The careful study of one man over a long period of time has added to the documentation of the disease, and delimited the significance of some known viruses in its aetiology, but has contributed nothing new. What a contrast is to be found in the series of papers dealing with the outbreak of encephalitis in the Murray Valley in Australia in 1951 and published in this journal a few weeks ago. Here a team of trained research workers focused all their special knowledge on the problem, and by the use of the chick embryo isolated a virus from the first autopsy specimens submitted to them. This was brain tissue from a patient who died on the thirteenth day of his illness. The virus proved to be a source of good antigen when grown in the allantoic cavity, and from complement-fixation tests on paired sera from patients, contacts, and possible animal hosts which might be concerned in the transmission, an enormous amount of information on the disease was provided within a matter of weeks.

The reader of Afzelius-Alm's work has two predominant impressions: firstly, the enormous amount of patient work which has gone into the clinical analysis of cases, and secondly, the laboratory tragedy of the lack of an extremely important technique of chick embryo culture, and the deeper tragedy of the loss of the transmissible agent which he did succeed in isolating. Had that material been divided between a group of workers, it is possible that some of it might have survived, and a whole line of investigation could have been pursued usefully. In modern research, the special techniques which are needed demand a band of skilled workers, each equipped with time as well as material, so that when the opportunity presents, it can usefully be employed.

BLOOD "SUBSTITUTES".

THE great interest in and development of the use of human whole blood and its derivatives in the past few years have been intensified by the threat of atomic warfare, especially in the United States, where extensive planning

and stockpiling appear to be going on. The same circumstances have stimulated work on various "substitutes" for blood or its components. The present position in the development of "substitutes" and their practical application has been set out in a report, the publication of which is authorized by the Council on Pharmacy and Chemistry of the American Medical Association.¹ The report points out that human whole blood, plasma or serum is preferred for the life-saving task of restoring circulatory blood volume in shock, because they provide a more complete and lasting form of replacement than can be obtained with artificial colloids or with ordinary isotonic fluids otherwise useful to combat loss of water and essential ions in other conditions. Whole blood is preferred for shock complicated by hæmorrhage or severe traumatic injury with loss of functioning blood cells; failing compatible whole blood, plasma is the logical "substitute" as it provides more components needed for clotting than does serum. If used for hæmorrhage or traumatic shock, "substitutes" should be limited to an amount sufficient to raise the systolic blood pressure not more than 80 to 85 millimetres of mercury; excess may cause more bleeding and dangerous blood dilution. For shock without significant destruction or loss of functioning blood cells, plasma or serum to overcome hæmoconcentration is theoretically preferable to whole blood. However, with traumatic shock secondary to severe burns or crushing injuries, blood cells as well as plasma are lost in the zone of injury, and the peripheral venous hæmatocrit values indicating hæmoconcentration may be misleading; hence whole blood is preferred, to combat peripheral circulatory failure and to prevent secondary anaemia. The broad generalization made in the report is that "it is likely that whole blood (possibly with buffered sodium solution to furnish electrolytes) is the replacement fluid of choice for all forms of traumatic as well as hæmorrhagic shock".

It is important, however, to have "substitutes", either ordinary isotonic fluids or artificial colloids, especially for emergency use, though the report stresses the view that such "substitutes" should not be regarded as replacements but rather as temporary "supportives" of blood volume and arterial pressure. At present various colloid preparations which have been proposed for the management of shock and oedema are under investigation to determine which of these is best suited for stockpiling and use in any emergency which might deplete or exhaust the supply of blood and its derivatives. None has been found which is entirely free from disadvantages. The difficulties involve the selection of a foreign material which will provide the desirable qualities of human plasma and be completely metabolized and which will not produce toxic or allergic reactions in the recipient. From the standpoint of practical use, the report states, a "substitute" should also have sufficient stability to permit storage, distribution and administration under various environmental and emergency circumstances. The availability and cost of manufacture are factors which also require consideration. Among the "substitutes" considered in this report are a 6% to 7% solution of acacia (gum arabic), human ascitic fluid, animal plasma proteins, gelatin, dextran, an unnamed mucilaginous polysaccharide extracted from okra, pectin, polyvinylpyrrolidone (a synthetic polymer derived from acetylene), methyl-cellulose and isinglass. Each has its good and bad points. The only two mentioned as being approved for stock-piling by the National Research Council are gelatin and dextran. In summing up the report states that none of the available artificial colloids can be regarded as suitable or desirable for use in the treatment of shock except in emergencies. The absence of usable protein from the synthetic products makes them wholly ineffective for replacement of lost blood protein. Animal blood derivatives cannot supply the cellular elements lost by hæmorrhage or blood destruction, and they have other disadvantages. Efforts to conserve the supply of human whole blood and its components are therefore essential. Since the supply of human blood and its derivatives is limited, further investigation of blood "substitutes" which

¹ *Acta medica Scandinavica*, Supplementum 263, 1951.

¹ *The Journal of the American Medical Association*, October 13, 1951.

will sustain blood pressure and volume in emergencies is warranted and should be encouraged. However, until more is known of the effectiveness and ultimate metabolism of the synthetic materials, their clinical application should be restricted to investigation except for purposes of stockpiling for emergency.

NEW PROBLEMS IN THE TREATMENT OF INFECTIOUS DISEASES.

It is ironical that just when we are beginning to think that the conquest of infectious diseases is well under way and are turning our attention hopefully to other groups of conditions, disturbing new problems in the control of infection are arising. Prolonged experience with antibiotics and other modern drugs is revealing unexpected and subtle difficulties in their use. Three of the major problems were discussed by C. Phillip Miller¹ at a meeting of the American College of Physicians last year. The first, which is more or less generally appreciated, is the rising incidence of infections caused by drug-resistant bacteria. The rapid development of streptomycin-resistance is perhaps best known, but the slower development by some organisms of resistance to penicillin, and almost certainly to the newer antibiotics, must also be faced. Particularly disturbing is the increasing incidence of penicillin-resistant staphylococci. The position with pneumococci appears to be a little more reassuring. The explanation of the increasing number of resistant organisms is not yet settled. Miller quotes evidence to suggest that it is due not to the development of acquired resistance, but rather to the gradual reduction in numbers of naturally sensitive strains; this leaves the field open to naturally resistant strains that have always been present. Fortunately, most penicillin-resistant staphylococci are sensitive to some other antibiotic or to combinations of them. Even combinations of antibiotics, however, are under tentative suspicion. Recent experimental work has suggested some sort of "antagonism" between antibiotics; for example, chloramphenicol and aureomycin have been found to reduce the effectiveness of penicillin in the test tube and in experimental infections in mice. The clinical significance of this, if any, has not yet been shown, but it at least serves to reinforce the view that antibiotics must be used with discrimination. The importance of a bacteriological diagnosis in terms of antibiotic sensitivity cannot be over-emphasized. Another danger, not mentioned by Miller, but brought to mind by his paper, is the development of a false sense of security by the use of antibiotics; "under penicillin cover", for example, sounds deceptively safe. Realization of the increasing incidence of antibiotic-resistant organisms will remind the surgeon or the physician that antibiotics are only one factor in modern aseptic technique or schemes of treatment. Wounds did heal by first intention and patients with pneumonia did recover in the days before antibiotics.

The second problem mentioned by Miller is the occasional occurrence during antibiotic therapy of complicating infections caused by bacteria insensitive to the antibiotic being used, and sometimes by microorganisms usually regarded as non-pathogenic. They are particularly apt to arise in the respiratory tract in children, or in old people suffering from debilitating disease. Such infections may arise from a disturbance of the "balance of nature" in a particular area—a change in the bacterial flora of, for example, the pharynx with a disturbance of the equilibrium maintained by the bacterial antagonisms within the normal flora. The question of equilibrium in bacterial populations in particular areas is imperfectly understood, but enough is known to make us respect the selective action of individual antibiotics.

Finally, Miller refers briefly to the effect of ACTH and cortisone on infection. These drugs appear to interfere with the host's defensive response to bacterial invasion. Severe infection can occur with suppression both of the acute localizing reaction that normally develops at, for example, the site of skin inoculation, and of fever and the

other signs of generalized infection. Thus an infection can become established and, in fact, out of hand before its presence is realized. This is a treacherous phenomenon that needs to be widely appreciated. As with the antibiotics so with ACTH and cortisone—they need respectful and informed handling if they are to be our friends and not our foes.

THE TREATMENT OF BRUCELLOSIS.

BRUCELLOSIS (undulant fever) is not a common condition in Australia, if we may judge by the number of cases notified to the public health authorities. These average no more than one per week for the whole of the Commonwealth. Whether there are more cases undiagnosed we have no means of knowing, but certainly the condition exists. Its comparative rarity and its insidious nature present problems in diagnosis, and this has added to the difficulty experienced in treatment in the past. The introduction of sulphonamides and of antibiotics, especially the more recently developed antibiotics, has brought considerable advancement in the therapy of brucellosis, though the complete answer has not yet been obtained. A recent study reported by W. W. Spink, W. H. Hall and R. Magoffin gives an indication of the present position.¹ This study was concerned with 48 patients suffering from bacteriologically proved brucellosis. The infecting organism was *Brucella abortus* in 44 cases, *Brucella suis* in two cases and *Brucella melitensis* in two. The patients were treated in one of the following three ways: with a combination of streptomycin and sulphadiazine, with aureomycin or with chloramphenicol. Of 21 patients treated with streptomycin and sulphadiazine, 11 promptly recovered and remained well; organisms were grown from the blood of six patients after treatment, although two of these patients had no complaint of ill health; five patients had residual complaints of ill health. Of 22 patients treated with aureomycin, 14 recovered promptly without a relapse; three patients had a relapse (organisms were grown from the blood of one), and five patients had residual complaints of ill-health. Of eight patients treated with chloramphenicol, two recovered completely, one showed no improvement, one had persistent bacteraemia, and four had residual complaints of ill health. Several patients in the series had severe complications, such as spondylitis, suppurative arthritis, radiculitis and subacute bacterial endocarditis; in every case these complications were brought under control as the result of treatment. One interesting point is that the result of therapy did not appear to be influenced by the duration of illness prior to treatment. Patients who had been ill for several months seemed to respond as well as those who had been ill for only a few weeks. Although all three methods of therapy appeared to have been effective in a significant number of cases, Spink and his colleagues consider that there was no question that aureomycin was superior to the streptomycin-sulphadiazine combination. In addition to its ease of administration, aureomycin also had the advantage of causing no serious side-effects. Two of the patients treated with streptomycin had persistent serious vestibular dysfunction. The overall results with aureomycin therapy were better than those obtained in the smaller series of patients receiving chloramphenicol. With none of the three methods of therapy were the results completely satisfactory. In each case a significant number of patients relapsed or had residual complaints of ill health. Thus, while it is apparent, as Spink, Hall and Magoffin point out, that considerable progress has been made in the therapy of brucellosis, further investigations with other drugs or combinations of drugs are necessary. One combination which is now being evaluated in their clinic following favourable experimental and clinical reports is a combination of dihydrostreptomycin and aureomycin. In previous experience with this combination no toxic reactions from dihydrostreptomycin have been observed; but, as is pointed out, delayed hearing loss has been attributed to the use of this antibiotic, and further experience of it is required.

¹ *Annals of Internal Medicine*, October, 1951.

¹ *A.M.A. Archives of Internal Medicine*, October, 1951.

Abstracts from Medical Literature.

SURGERY.

Carcinoid Tumours of the Appendix.

GERALD N. WEISS AND AMBROSE J. HERTZOG (*Surgery*, October, 1951) report a study of 26 cases of carcinoid tumours of the appendix encountered in a department of pathology over a period of fifteen years. They state that argentaffinoma or carcinoid tumour is a unique and common neoplasm of the gastro-intestinal tract. The site of occurrence of the tumours may be from the stomach to the rectum, but they are far commoner in the small intestine and appendix. Carcinoid tumours or argentaffinomata are quite different from the occasional gland-coll adenocarcinoma which may be found in the gastro-intestinal tract. It can be expected that one in every 500 appendicectomies will reveal a carcinoid tumour, but in a large percentage of cases the tumour will be recognized only on microscopic examination of the appendix. The common site of the tumour is at the tip of the appendix, and as a rule there is partial fibrous obliteration of the lumen of the appendix. In none of the authors' cases was there evidence of metastasis, which is extremely rare.

Flexor Tendon Grafting to the Hand.

HARVEY S. ALLEN (*Archives of Surgery*, September, 1951) states that to unite the separated ends of a flexor tendon within the strict confines of the dense fibrous sheath of the digit creates a difficult problem. To secure union of the separated tendons within the sheath and later to hope for a gliding mechanism to provide flexion is almost a paradox. Unsuccessful results in this area of "no man's land" in the hand are rather common after primary end-to-end repair. It is probably wiser in many cases to obtain kindly and early healing of the soft parts so that later repair may be performed. For the repair delayed or secondary reconstruction demands the insertion of a free tendon graft, as such a procedure brings normal tendons into the digit and does not require a line of union of the tendon ends to be placed within the limits of the fibrous tendon sheath. The siting of the skin incision is of extreme importance, and digital nerves and vessels must be identified and protected. The author maintains that the sheath tissue must be protected and preserved in order to obtain the pulley action. The distal segment of the tendons is visualized, freed from the sheath and brought out at the level of the distal phalanx. The proximal end of the tendon may be difficult to find and secure. If the sublimis tendon has been divided, the distal portion should be excised. The tendon for grafting is obtained from the long extensor of the toes and occasionally from the *palmaris longus*. The tendon must be exposed through a long incision, as surrounding sheath and paratenon should be taken with it. The distal segment of the profundus tendon is isolated up to its insertion in the distal phalanx. A deep inserted "V" is made in this distal seg-

ment, and the excess of tendon is excised; two lateral slips are left, each measuring about one centimetre. At the apex of the "V" periosteum is dissected away so as to leave a triangular-shaped area of raw bone. The end of the tendon graft is sharpened so that it can be inserted into the previously prepared "V". The tip of the sharpened graft is placed at the apex and united to the lateral slips of the remaining profundus tendon segment with interrupted silk sutures. Because the proximal end of the graft is smaller than the proximal motor tendon, end-to-end suture is not desirable, and the author describes a method of inserting the graft through a small stab incision in the proximal motor tendon. Union is again achieved with interrupted silk sutures. The tension of the graft must be correctly judged. The hand and wrist are splinted in flexion for three and a half to four weeks.

Late Results of Surgery in Perforated Duodenal Ulcer.

E. BRUCE TOVEE (*Archives of Surgery*, September, 1951) states that he is a member of a group who, in 1944, reported the immediate management of 114 patients with perforated duodenal ulcer. This group practised the sealing of the perforation with a piece of omentum and three sutures, and nothing else was done. The mortality rate was 6.3%. The author attempted to follow up these patients to find out what had happened to them in the ensuing years. Eleven of the patients had since died from causes unassociated with the gastro-intestinal tract; these fell into the later age group, but six of them had had typical or severe ulcer symptoms in the years prior to their death. Fifteen patients could not be traced, and so the total number of patients followed up was 78. Of these one-third had no symptoms or mild symptoms, one-third had typical or severe symptoms, and one third had undergone further operation—gastric resection, gastro-enterostomy or closure of another perforation. The author produces analysis of data relating to age, diet, addiction to smoking and alcohol, and sex. He states that the group concerned plans to teach and practise simple closure for this condition until it can be convinced that a better method of treatment is available.

Effects of Ligation of Hepatic Artery in Dogs.

D. FRASER, A. M. RAPPAPORT, C. A. VUYLESTEKE AND A. R. COLWELL, JUNIOR (*Surgery*, October, 1951), state that they undertook experimental ligation of the hepatic artery in dogs to repeat the work of Markowitz, Rappaport and Scott, who reported that the mortality of dogs following complete ligation was reduced greatly by intensive penicillin therapy, and to investigate in detail certain changes taking place in the liver of dogs who had undergone this operation. Three groups of dogs were studied: (i) a group of 11, in which the artery was tied, but to which no antibiotics were administered; (ii) a group of 20, in which the artery was ligated and to which antibiotics were administered for ten days post-operatively, 14 receiving penicillin only, six receiving a combination of antibiotics; (iii) a group of six "sham-ligated" dogs, in which the hepatic artery was not tied. The mortality rate for each group was

determined, and histological and bacteriological studies were carried out on the livers at the time of death. The antibiotic therapy reduced the mortality rate after ligation of the hepatic artery from 90% to 35%. Both bacterial proliferation and reduced arterial blood supply were important factors in causing hepatic necrosis and death following ligation of the artery. A number of dogs died despite intensive antibiotic therapy. Hepatic necrosis was present, and in some of the dogs there was evidence to suggest that death had resulted from ischaemic necrosis which had developed despite complete suppression of bacterial proliferation by the administration of antibiotic agents. In the small group which received a combination of antibiotics both before and after the ligation, the mortality rate did not differ from that of the dogs receiving penicillin only. A small, fairly constant increase in collateral arterial circulation to the liver was observed in all the animals examined. Liver function tests were carried out in the dogs treated with antibiotics. Two-thirds of the dogs, after transient liver insufficiency, yielded normal results to liver function tests on the twelfth day after operation.

Parenteral and Intestinal Absorption of Antibiotics in Traumatic Shock.

WILLIAM A. ALTEMEIR, ROBERT L. COITH AND WILLIAM R. CULBERTSON (*Archives of Surgery*, September, 1951) state that as part of a group they have studied parenteral and intestinal absorption of antibiotics in relation to traumatic shock. The experiments were carried out on 46 dogs. The authors state that in view of the possibility of large numbers of casualties under conditions of a major catastrophe, such as an atomic attack, the question of oral administration of antibiotics is important. Analysis of the results obtained in these experiments indicates that traumatic shock, even with its attending depression of vital activities, permits the absorption of penicillin and aureomycin from the gastro-intestinal tract after oral administration and from the skeletal muscles after intramuscular injection. Antibacterial levels develop at the same rate in shock as in the normal state, but in one-half of the animals the development of maximum levels was retarded for half an hour in the case of penicillin and for one to two hours in the case of aureomycin. It was observed that the antibiotic levels fell more slowly and persisted at higher levels for longer periods of time during shock. The antibiotics were diffused into traumatized tissue and tissue fluids in adequate concentration and with active antibacterial properties. Penicillin was absorbed more rapidly after oral and intramuscular injection than aureomycin, both in the presence and in the absence of shock. The intramuscular injection of aureomycin caused great local irritation and is not recommended for human patients.

Gastric Aspiration and the Prevention of Asphyxia in the Newborn.

DAVID M. LITTLE, FRANK H. D'ANDREA AND ANGELO MASTRANGELO (*Surgery, Gynecology and Obstetrics*, September, 1951), from the department of anaesthesia in the Stamford Hospitals, Connecticut, present a study showing distinct reduction in the mortality rate

of infants born by Caesarean section since the introduction of gastric aspiration. They state that it has long been recognized that the incidence of respiratory difficulty is higher after Caesarean section than after delivery through the pelvis. One form which this complication may take is that of a syndrome of delayed respiratory distress occurring in the newborn infant some minutes to hours after delivery by Caesarean section and the initiation of apparently normal respiratory activity. This respiratory distress is of an obstructive nature, and in certain instances the clinical course has progressed to restlessness, convulsions and death. It is generally conceded that the aspiration of amniotic fluid may indeed account for signs of respiratory distress in the immediate neonatal period. The theory has been proposed by Gellis, White and Pfeffer that an excessive amount of amniotic fluid is ingested at or prior to delivery, and may be regurgitated and aspirated, thus accounting for the late onset of respiratory embarrassment. Following this supposition, the authors introduced the technique of gentle gastric aspiration for all infants born by Caesarean section with a reduction of the fetal mortality rate by approximately 50%.

Antethoracic Jejunal Transplantation for Congenital Oesophageal Atresia.

W. P. LONGMIRE, JUNIOR (*Surgery, Gynecology and Obstetrics*, September, 1951), describes two infants upon whom antethoracic oesophageal reconstruction was performed with mobilization and transplantation of a segment of jejunum. The transplanted segment was long enough to extend from the cervical part of the oesophagus to the stomach, and in both cases function of the reconstructed oesophagus has been satisfactory in the two years of the follow-up period. The author states that primary end-to-end anastomosis of the oesophagus with closure of the fistula is accepted as the procedure of choice in all cases in which the ends of the oesophagus may be satisfactorily approximated. However, not infrequently hypoplasia of the lower segment is so pronounced that primary approximation of the ends of the oesophagus is impossible, regardless of the tension employed. Study of the literature reveals only one successful case of transthoracic oesophago-gastrostomy in a newborn infant with a satisfactory three-months post-operative follow-up. The detail of the staged procedure is given.

Surgical Aspects of Acute Head Injury.

J. M. MEREDITH (*Surgery, Gynecology and Obstetrics*, September, 1951) presents a summary of the methods of diagnosis and treatment used in the management of acute head injuries at the Medical College of Virginia Hospital, Richmond. He states that 85% to 90% of patients with acute head injury require no major neurosurgical procedure. Apart from the primary débridement and closure without drainage of scalp lacerations at the time of, or within a few hours of, admission to hospital, no surgical procedure is required in the great majority of these cases, the burden of the post-traumatic

treatment being that of good nursing care and frequent scrutiny of the patient to be certain that no urgent surgical emergency is developing. Shock rarely accompanies acute head injuries, and when it does occur it is due to severe associated injuries of the chest, long bones, spine or abdominal viscera, severe blood loss, or the occasional severe basilar type of brain injury. The mortality from extradural haemorrhage is still in the vicinity of 50% owing to delay in operation or the occurrence of atypical cases from the symptomatic standpoint. In the author's clinic, the state of consciousness is emphasized as the most important single clinical sign in evaluating the individual case of head injury at any particular time. Surgical procedures used are chiefly diagnostic burr holes, usually in the superior temporal region, subtemporal decompression for the removal of large extradural and subdural hematomata and the elevation of depressed fractures, simple or compound. Post-traumatic cerebrospinal fluid otorrhea practically never requires operative interference, as the lesion closes spontaneously, but rhinorrhea occasionally necessitates operation and obliteration of the fistula. Morphine and other opiates are avoided, except post-operatively, in this clinic; chloral hydrate and bromide given rectally and paraldehyde given by rectum, intramuscularly and intravenously are used. As regards the advisability of dehydration in acute head injury, middle-road policy is adopted.

Pituitary Tumours.

HUGH C. TRUMBLE (*The British Journal of Surgery*, July, 1951) sets out to describe how tumours arising in the pituitary gland grow and extend beyond the confines of the *sella turcica*, and the way in which they affect the surrounding tissues and structures. He states that the growths may attain to a large size and bring about profound changes in the disposition of the neighbouring structures. He describes the methods employed in an endeavour to ascertain the size, shape and relationships of a large growth in a living patient. Chief among these are clinical examination, plain radiography, pneumography and arteriography. The author points out in connexion with the clinical examination that cranial nerves and other nervous tissues may continue to function very well even though grossly disturbed by the growth. Finally an endeavour is made to describe the appropriate methods of approach to and removal of large pituitary tumours.

Sex and Lobotomy.

J. LEVINE AND H. ALBERT (*The Journal of Nervous and Mental Disease*, April, 1951) discuss sexual behaviour after lobotomy and attempt to answer the question as to whether this operation results in impulsive, unpredictable sexuality. They state that 40 patients were interrogated who had undergone lobotomy. Six months to four years had elapsed between operation and interview. A considerable diminution in inhibition was noted in many cases. Feelings of guilt, modesty, embarrassment and anxiety concerning sex were decreased. Some patients became better marital partners on the sexual plane,

but the type of heterosexual or homosexual activity was unchanged. None of the patients were involved in legal difficulties through sex. Erotic fantasies appeared to be lessened after lobotomy. Moral, social and religious attitudes continued on the pre-operative pattern. The survey did not indicate that a possible post-lobotomy development of sexuality should be regarded as a deterrent to the operation.

A Review of the Symptoms and Signs of Acoustic Neurofibromata.

C. H. EDWARDS AND J. H. PATERSON (*Brain*, Volume LXXIV, Part II, 1951) review the clinical manifestations of acoustic neurofibromata, and put forward an analysis of 157 cases drawn from the National Hospital, Queen's Square. Their object is to throw some light on the earlier symptomatology of the disease and to render earlier diagnosis more certain. They state that despite the slow rate of growth of these tumours, the patients (76% in their series) usually present with the late signs of raised intracranial pressure on their first admission to hospital; with earlier diagnosis operative risks could be lowered and complications prevented. They discuss initial symptoms of the disease which allow of early diagnosis. These are symptoms referable to the acoustic and trigeminal nerves, followed by headaches and cerebellar ataxia. In this series of cases acoustic symptoms were the first to appear in 75% of cases, but a fair number of the patients complained of other symptoms at the onset. The authors believe therefore that Cushing's rigid chronological order of symptoms is not of practical value in early diagnosis and is given too much importance. They state that acoustic symptoms not infrequently escape the clinician's notice, that they are frequently mild and not disabling (for example, vertigo and tinnitus) and that they are often attributed to some mild aural condition. When headaches occur later on, and unsteady gait appears, aural factors may again be blamed; so it may be two or three years before the progressive nature of the disease is recognized. The acoustic neurofibroma, as a cause of deafness, tinnitus and vertigo, is greatly overshadowed by the more common aural diseases, and neurosurgeons rarely see the condition until it is considerably advanced. The authors state that the signs of cerebellar involvement and evidence of loss of trigeminal function (especially the corneal reflex) can be regarded as diagnostically important. These signs are simple to elicit and should be looked for in all clinical examinations (for example, nystagmus, gait and stance and corneal reflexes). In addition, the use of specialized investigations (as is the practice in certain clinics) is very well advised. The radiological examination of the temporal bone and special tests of cochlear and vestibular function are examples of these, and increase considerably the possibilities of early diagnosis. The writers conclude with the statement that more attention should be paid to the early signs described, and that if special radiological and otological procedures were used more frequently, the neurosurgeon would be able to achieve a greater degree of success than is usually achieved at present.

Special Articles for the Clinician.

(CONTRIBUTED BY REQUEST.)

IX.

DEAFNESS AND HEARING AIDS.

THE aim of the otologist is to prevent the onset of deafness and once it has begun to control its progress. However, in spite of all efforts the world is abundantly peopled with the hard of hearing. What help does modern science offer? Electric contrivances for amplifying the spoken voice have been growing in number and efficiency since they were first used half a century ago. As the result of tremendous developments in the field of electronics during the recent world war, we are enjoying startling advances in these instruments. The surgeon who does fenestration operations becomes enthusiastic, and justifiably so, if in about half his selected cases there is a 30 decibel gain in hearing. But also, it is not unusual for a well-fitted hearing aid to give a gain of anything up to 40 or even 50 decibels, and even those with very little hearing can profit from wearing one.¹

Hearing aids are now being used by people of all ages from the pre-school child to the extremely aged and from those with moderate hearing loss of 30 decibels to those who have a loss of 80 or even 90 decibels.

In the young deaf child the intelligent use of sound amplification is developing a clearer and more rhythmic speech than could be secured before this help was available. As a most useful supplementary measure to the use of the hearing aid, the child is nowadays taught the art of lip-reading. Even in the adult with progressive deafness it is highly desirable that lip-reading should be encouraged in the earliest stages, even before the use of an aid becomes necessary. The knowledge of lip-reading will be of great help at a time when hearing aids can no longer be used. On the other hand, the most highly accomplished lip-reader is able to "read" only about 70% of spoken words and the remaining 30% of words have to be guessed at. The more nimble the mind, the more accurate will be the result of the guessing and thus the more accurate will be the comprehension of speech. A hearing aid is therefore a great asset in bridging the gap.

In adult life the modern instrument is becoming so easy to wear and so efficient that past prejudices against its use are being rapidly overcome and it is much more commonly in use.

The fenestration operation is suitable for only a limited number of deaf persons, namely, certain otosclerotics, whereas a well-fitted aid can give amplification at least as great as that after surgery and to an acoustically wider group of hard-of-hearing persons, with less expense, discomfort and worry. Those patients suitable for operation are just those for whom the hearing aid gives its greatest boost.

When Does a Hearing Aid Become Necessary?

Almost without exception the hard-of-hearing patient needs a hearing aid before he seeks one or will accept it. He wishes to hide his infirmity. This is a human trait and an honourable one. At first deafness lends itself to such deception, for there is no external evidence of the malady, and at this stage the individual blames the other person for "mumbling" or the bad acoustics of the hall but not his own deafness.

Broadly speaking, a hearing aid is desirable when the hearing defect is such that, despite treatment, normal methods of communication are impossible or irksome. To some extent the patient's type of occupation, habits and recreation comes into the picture. For example, a business executive would feel the need of an aid long before a farm labourer and a stenographer before a domestic.

In order to determine from the audiogram whether a subject can lead a normal life without a hearing aid, it is necessary to examine the most essential area for speech interpretation, the pitch or tonal area of frequency of sound of 1024 to 2896 cycles (or double vibrations) per second. At least 70% of intelligibility of speech appears to be dependent on this region and it is here that many of the impor-

tant but weaker consonant elements of speech occur. Further, because of the greater sound power of vowels and other speech elements in the lower frequency range (256 to 1024 cycles per second), an impairment for this lower tonal area is generally not so severe a handicap as an impairment in the higher range.

In other words, the difficulties of the hard of hearing in understanding speech are caused not only by the general diminution of the sound perceived but also by the loss of important characteristics. Vowel sounds may be recognized satisfactorily as a rule, but the characteristic elements of many consonants are lost. Intellectual effort is often able to fill the gaps unless many words of a sentence are misinterpreted. Hence the frequent complaint that the speaker "will mumble" or that he "won't speak up" or he is told: "Don't shout, but only speak clearly—I'm not deaf!"

In this most critical area from 1024 to 2896 cycles per second, the level of hearing loss at which a subject's handicap for speech in daily life becomes sufficient to require the use of a hearing aid is a hearing loss of between 30 and 40 decibels above normal threshold for hearing. Impairment for direct conversation begins at this level of deafness whilst impairment for public address and "sound-cinema" begins at a slightly earlier stage of the deafness.

What Degrees of Deafness are Likely to be Benefited by Hearing Aids?

A hearing loss of 20 to 30 decibels in the critical region is not profound, but a hearing aid may be of assistance. If the deafness is progressive, the patient should be urged to use an aid as occasion urges and so to get accustomed to it against the possible day when its use must be more constant. When the decision has been made to secure a hearing aid, he is advised to select the instrument that seems to suit him best and to insist upon trying it out in his own normal environment at home and not only in the artificial surroundings of the agent's office. Before the final purchase he should have it reviewed by his otologist.

A total loss of serviceable hearing occurs at the level of 90 decibels in the lower range of 512 to 1024 cycles per second and 95 decibels in the upper range of 1024 to 2896 cycles per second. Such losses are extreme, and good hearing cannot be supplied to any individual with losses in excess of these levels even by the best hearing aids. In such extreme cases, the range between the threshold of hearing and the point at which sound becomes a painful sensation is very narrow and this is accentuated if deafness of the recruitment type is present. In this latter type of nerve deafness, loud tones are heard with a loudness equal or nearly equal to that heard by the normal ear. Amplification of these loud tones becomes intolerable for the ear, and if persisted in may lead to acoustic trauma.

A powerful hearing aid used by an extremely deaf subject serves only to provide a partial key to the phrasing, timing and pitch of the speaker's voice. Real understanding and intelligibility cannot be obtained through the use of the aid alone, and training in lip-reading should be strongly urged.

Can a Hearing Aid Do Harm?

A common lay belief is that a hearing aid may injure the hearing. This idea probably arises from the fact that once a user accepts such an instrument he discovers how much he has been missing and is no longer satisfied with his unaided ear. Thus, to himself he seems deafier than he used to be. In point of fact, the use of a hearing aid tends to increase rather than to decrease acoustic intelligence. Disuse of any function can only encourage its atrophy. However, the possibility of resulting acoustic trauma in extremely deaf patients, as previously mentioned, must be borne in mind. The patient must be warned to turn down the rheostat control when the noise becomes excessive, unless his aid is provided with a special automatic volume regulator.

Principles in the Selection of the Ear to be Fitted.

Binaural hearing always improves hearing ability remarkably, even where only a small amount of actual hearing is provided by one ear. It permits easier localization of sound and facilitates discrimination, selectivity and concentration in the presence of poor acoustics, masking noises and other interferences. To appreciate this, a person with two normal ears needs only to stop up one of his ears while listening to a speech in a hall with poor acoustics.

There are certain definite principles that determine when to fit the better ear and when to fit the poorer ear, or which

¹ In audiometry, the hearing loss is measured in units called decibels. A decibel is a unit of relative intensity and is the smallest increase in sound appreciable by the normal ear. It is a logarithmic unit in which 10 decibels would correspond to a tenfold increase in sound intensity, 20 to a hundredfold, 30 to a thousandfold and so on.

ear to fit when the two ears are alike in their audiogram curves:

1. If the better ear has a loss of less than 50 decibels in the essential tones of the speech range, the poorer ear should be fitted if good results can be obtained in that ear.

2. If the better ear has a loss of more than 50 decibels in the essential speech range, the better ear may be fitted because it is of almost no direct benefit without a hearing aid and no binaural advantage will be obtained through fitting the poorer ear.

3. If the poorer ear has a severe loss of over 75 decibels, the better ear may be fitted even though the loss in the better ear is less than 50 decibels.

4. If the audiograms of the two ears are nearly identical, it is advisable to fit the ear which has the better perceptive and interpretative ability. The factor of recruitment is also important. Recruitment at lower intensity levels is an advantage to an ear. An ear with 50 decibels or less of loss which has a strong initial recruitment just above threshold of hearing should be left unfitted and the other ear with less recruitment fitted.

The modern air conduction apparatus, for obvious reasons, should not be fitted to an ear involved in *otitis externa* or chronic suppurative *otitis media*.

Types of Hearing Aids.

Carbon Type Aid.

The early electric hearing aids had the carbon type of microphone and are now but little used. In them there was little or no reproduction of sound above 1800 cycles frequency. They are therefore suitable only for mild types of deafness in the frequency area below 1800 cycles per second.

Vacuum Tube Aids.

Vacuum tube aids are constructed on the principle of a telephone receiver coupled to a microphone. The sounds are picked up by the microphone, converted into amplified vibrations and then transmitted to the receiver. The transmitter microphone is of the crystal type which enables the patient to hear from a relatively long distance. The amplification is furnished by three or four vacuum tubes similar to those in radio sets but of much smaller dimensions.

The receiver may be of the bone conduction type applied to the mastoid region or it may be of the air conduction variety which is specially moulded to fit the auditory canal of the individual.

The limitations of bone conduction receivers today are that they tend to give strong emphasis in the lower and middle frequency ranges but poor reproduction in the higher consonant range from 1800 to 3000 cycles per second, which is by far the most important for intelligibility of speech. Moreover, many hard-of-hearing individuals need most correction in this higher consonant range. The oscillator of the bone conduction receiver is too slow and does not amplify frequencies over about 2000 cycles per second, whereas the amplification of air conduction receivers is practically unlimited.

On the whole, better performance can be expected from an air conduction than from a bone conduction instrument even by those people in whom bone conduction is very good. There is less distortion of sound in the former and it takes many times the electrical energy to make an individual hear by bone conduction than by air conduction.

Bone conduction instruments are used in about 10% of cases. Their use is confined to those with discharging ears, to those with an irritative eczema of the external auditory canal, in addition to those patients in whom there is a marked impedance in the middle ear and little superimposed inner ear deafness (that is, those who have exceptionally good bone conduction).

If the difference between the average loss in the speech range by air conduction is 40 or more decibels greater than by bone conduction, the bone conduction receiver should be prescribed.

Each prospective buyer of a hearing aid should have his own individual ear mould fitted before he tries an air conduction instrument. There are too many chances for "feed back" squeals and other extraneous noises if a standard ear-piece is used.

Some Further Practical Considerations on Electrical Hearing Aids.

It is necessary to qualify the enunciation of the foregoing principles on the fitting of valve tube aids by the following common findings in actual practice:

1. The audiogram is necessary for complete diagnosis, but is of relatively little value in the fitting of hearing aids. It is unpredictable with absolute certainty even from audiograms which hearing aid will suit best. The fitting must eventually be made by trial and error.

2. Tests over a large number of cases indicate that there is little justification for the use of selective amplification in fitting most hard-of-hearing persons with electric aids. Regardless of the nature of the particular hearing defect, speech comprehension in most patients is best with an instrument which amplifies all frequencies uniformly or one with moderate emphasis in the higher sound frequencies.

3. The aged individual with advanced senile deafness often does not take very kindly to electric hearing aids for the following reasons: (a) Just as he always finds it difficult to interpret speech in group conversation, his speech comprehension with an electric hearing aid is distracted by the rustling of clothing on the microphone and by background noise, both of which sounds are of physical necessity also amplified. (b) He is often somewhat intolerant and consequently unwilling to persevere sufficiently to overcome his difficulties. (c) He sometimes may be frightened by the mechanics of adjusting a complicated electric device. (d) He may have inner ear deafness of the recruitment type in which loud tones may become quite unbearable. Such an individual should be content with a little boost from his hearing aid and he must then piece out the consonant pattern of speech (the range of which he has most difficulty in hearing) by means of lip-reading. The mastery of the art of lip-reading is of course almost insurmountable in the later decades.

Speaking Tube or Trumpet.

Strangely, very hard-of-hearing patients, particularly the elderly ones, can use the old-fashioned speaking tube with considerable benefit.

Auditory Training.

Finally, it must be stated that in addition to lip-reading auditory training is a very important phase of rehabilitation of the deaf. Its purpose is to develop the patient's power of interpretation of the sound he hears. A much higher percentage of the patients fitted with hearing aids continue to use these instruments satisfactorily and successfully after auditory rehabilitation.

BERTHOLD HILLER,
Hobart.

British Medical Association News.

SCIENTIFIC.

A MEETING of the South Australian Branch of the British Medical Association was held at the Institute of Medical and Veterinary Science, Adelaide, on July 26, 1951, Dr. C. O. F. RIEGER, the President, in the chair.

Sciatica.

DR. J. R. BARBOUR read a paper entitled "Sciatica and Such Conditions of the Back as Accompany It" (see page 285).

DR. M. E. CHINNER said that backache from a medical or physician's point of view resolved itself into the functional and organic types. Referring first to functional backache, Dr. Chinner said that often the patient had suffered some relatively insignificant back strain or injury, and then, owing to psychological causes, such as domestic unhappiness or financial troubles, a fixation complex developed. Those patients were not relieved until their psychological troubles were solved. Then there was the type of person who was classed as a "neuropathic personality"; they presented with many and varied symptoms, but backache was often one of the foremost. Dr. Chinner often thought that such people were in a state of muscle hypotonia and might really suffer some pain because of strain. Finally, there was the malingerer, who manufactured a backache in order to escape something undesirable or to perpetuate a state of invalidity; those people were very difficult to assess, as a backache could not be measured by anything concrete, and only by the general set-up and full consideration of all the facts could such a diagnosis be made. Dr. Chinner then considered organic backaches. He said that they were, of course, far too numerous to consider at the meeting, and many had been considered by the main speaker; backache due to

pelvic disease in the female patient would be considered by the gynaecologist. He (Dr. Chinner) would mention some conditions not infrequently met with. The first was backache associated with viscerotoposis, which was probably partly due to visceral referred pain and partly psychoneurotic; other visceral diseases, such as chronic peptic ulcer, chronic pancreatitis and gall-bladder disease, would cause backache. Second, in patients with dyschesia a low back pain was common and would not be rectified until an understanding of the cause was obtained by the patient. Third was the large group of arthritides—ankylosing spondylitis in the sacro-iliac joints and dorsi-lumbar part of the spine would undoubtedly cause severe pain, but in many instances Dr. Chinner doubted if the presence on X-ray evidence of *spondylitis deformans* in the lumbar vertebrae caused much pain, until the patient heard of the radiologist's report. Fourth, there was a definite group of conditions, maybe not common, in which the backache depended on a state of osteoporosis, as was found in post-menopausal states, in advancing age in both sexes, following enforced bed rest *et cetera*, and in which the bones were decalcified and softened owing to a falling off in sex hormones, which were necessary for protein anabolism; without that osteoid tissue, which was of protein content, could not be formed and osteoblasts therefore could not produce bony tissue, though there was no deficiency in blood calcium content. The treatment of that variety of osteoporosis was by sex hormones, testosterone being the most efficient. Fifth, many malignant states in various organs, for example, the breast, prostate, kidney, lung and thyroid, would metastasize in bone, and that would cause backache of great severity owing to vertebral body collapse; that must never be forgotten as a cause, and X-ray examination should always be made. Dr. Chinner said that he had known osteogenic sarcoma in the ilium to cause terrific backache. Sixth, inflammatory states, mainly subacute, as in tuberculosis, osteomyelitis and typhoid fever, had to be considered. Seventh, rarely a persistent backache was caused by the development of multiple myelomatosis; that disease was often difficult to diagnose early, and in an obscure case full skeletal X-ray examination and marrow biopsy should always be carried out. Eighth, one might go on in the same strain for a long time, but before stopping Dr. Chinner said that he must mention Paget's disease of the vertebrae; in that disease the bones were softened and the bodies of the vertebrae might collapse with pressure on nerve roots, or there might be compression of the cord with possible paraplegia.

Dr. R. M. MacINTOSH said that he would like to join Dr. Chinner in congratulating Dr. Barbour on his very fine and comprehensive paper on a most difficult subject. Dr. Chinner, too, was to be congratulated on his excellent review of the medical causes of backache. Dr. MacIntosh said that he did not wish to bore his listeners with a long list of the gynaecological causes of backache—rather would he like to play down the gynaecological aspect of the symptom. Emil Novak had said, "a woman complaining of backache usually has something wrong with her back". Although many women believed that low backache meant that something was wrong with their pelvic organs, the cause was more often likely to be orthopaedic in origin than gynaecological. Backache then was rarely a primary symptom of gynaecological disease, and Dr. MacIntosh would emphasize the need for careful examination of the back including X-ray examination when indicated. He went on to say that when backache was a symptom of gynaecological disorder it was usually referred pain over the lower lumbar and sacral regions. The pain was of a dull aching character, often worse at the menses, and if due to uterine prolapse, it was relieved on the patient's lying down and could be reproduced by traction on the cervix. Persistent backache of gynaecological origin was always accompanied by some visible or palpable pelvic abnormality. However, backache of orthopaedic origin and a pelvic lesion could and did coexist, and one should always be careful to ascertain whether the pelvic lesion was responsible for the backache or not. Dr. MacIntosh said that he would say no more about the inflammatory lesions, carcinoma invading the pelvic wall directly or by metastasis, endometriosis and large benign pelvic tumours; the treatment, whether it was operative or conservative, would depend upon the pathological condition present. However, he would like to "highlight" one condition for which operations were often performed unnecessarily—namely, retroversion of the uterus. Retroversion might be congenital or acquired. The congenital type did not produce any symptoms and did not need any treatment. Acquired retroversion might be mobile or fixed, and if mobile it might be symptomless or it might produce symptoms, one of which might be backache. The symptomless type was often encountered shortly after parturition, and if the uterus had been formerly anteverted,

the position should be corrected by knee-chest exercises and a ring pessary if necessary. The retroversion with symptoms was usually of long standing and was often accompanied by retroflexion. The treatment was to correct the position of the uterus and put in a ring pessary. If the backache was due to the retroversion it would be relieved, and would recur when the ring was removed. If that was so, then operative treatment was justifiable. Fixed retroversion was usually due to chronic pelvic inflammatory disease or endometriosis, and the treatment would depend upon the pathological condition present. As a final word on retroversion, Dr. MacIntosh said that one should beware of early prolapse, of which retroversion might be an early sign—a Gilliam operation was not a cure for prolapse. With regard to prolapse, it must be remembered, too, that the patients affected were often post-menopausal, they might be hard-worked and over-tired, and their backache might not be due entirely to their prolapse. Dr. MacIntosh said that he would not discuss the obstetrical causes of backache as that would take too much time, but he would conclude by again emphasizing the need for circumspection in the diagnosis of gynaecological backache, and the necessity for at least a careful clinical examination of the back.

Dr. E. F. West congratulated Dr. Barbour on the presentation of his paper. He said that he (Dr. West) adopted a more conservative attitude in the treatment of disk lesions. In most cases the symptoms subsided with rest and he thought that conservative treatment was worth a trial in the form of a period of two weeks' rest in bed, followed by the wearing of an efficient spinal brace whilst the patient was ambulatory. If the pain was not relieved by those means, then he did not think that operation should be delayed, and it should also be performed if the pain recurred. He had found the best results from operation to be in those cases in which there was severe pain, not relieved by rest in bed. The severity of the pain and extent of Lasègue's sign indicated the degree of disk protrusion with stretching or compression of the nerve root; the most satisfactory results were obtained in those cases in which a large herniation presented at operation.

Dr. OWEN BOWERING asked Dr. Barbour if he could explain the mechanism of spontaneous disappearance of pain due to disk lesions. Was it due to the spontaneous reduction of the hernia or to the dropping off of the protruded portion?

Dr. ALAN CHERRY said that he would like to ask Dr. Barbour whether he favoured putting the average patient with "strained back" to rest or treating the patient ambulatorily. The present trend would appear to be to rest them initially; whereas in the army they had been instructed to keep such patients on their feet if possible. He felt a little remorseful now to think of how he had treated some such patients in his service days.

Dr. NEVILLE WILSON said that Dr. Barbour had concentrated his opinions on the treatment of back pain with sciatica to cases in which there were neurological signs; in those the indications for treatment were more clearly defined than in the multitude of back conditions mentioned by other speakers. Dr. Wilson tended to a more conservative approach. The application of a plaster jacket seemed to him worth while, for if it was not helpful at an early stage, it aggravated the pain. That was good reason for urging operation. Unexpected compression trauma to a back had, on occasion, given complete relief of sciatic pain.

Dr. N. J. BONNIN said that he thought that a word about manipulative treatment would not be out of place. Some words had in fact been said already. Dr. Barbour had mentioned the tendency that the patients under discussion had to drift from doctor to chiropractor, and Dr. Wilson had quoted a case of immediate cure following manipulation of a patient of his by a cow. If treated early many of the patients could be cured immediately and dramatically by a simple manipulation. The patient lay on his back, and one leg (usually the leg in which the patient had pain) was flexed at knee and hip, so that it was doubled up as far as comfort would allow. Then with the operator supporting the leg the patient was encouraged to kick the leg out so as to attain a position with the knee straight and the hip flexed about 30°—a position with the straight leg raised about 30° from the bed and supported by the operator. At the end of the patient's kick the operator pulled the ankle in the line of the leg, catching the muscles of the back "off guard". The movement was at first carried out slowly and gently, and then repeated time and again with more force on the part of both patient and doctor as the patient's confidence was gained. There was little difficulty about gaining his confidence, as the manoeuvre was usually quite painless. Finally, after about six or eight kicks, sufficient force was used to jerk the patient along the bed an inch or two, and that was

repeated two or three times. If pain was caused at any stage or if for any other reason the patient would not fully cooperate, then it was useless and possibly unwise to persist. The force was applied by the patient rather than the operator, who merely supported the leg and added a jerk at the end of the kick. The manoeuvre simply applied traction to the vertebral column with the spine in a "neutral" slightly flexed position and the muscles momentarily off guard. Presumably it released a piece of impacted cartilage. Dr. Bonnin said that he had been able to give immediate relief to at least a third or more of the patients he had treated in the first few days of an attack. As far as he knew the procedure was harmless, and he would strongly recommend it as well worth trying if a patient was encountered early in an attack of sciatica.

A MEETING of the Victorian Branch of the British Medical Association was held at the Medical Society Hall, Albert Street, East Melbourne, on November 14, 1951, Dr. ROBERT SOUTHEY in the chair.

Medical and Surgical Lessons of the Korean Campaign.

DR. B. GANDEVIA and DR. E. S. R. HUGHES read papers on the subject of "Medical and Surgical Lessons of the Korean Campaign".

Dr. Gandevia said that it was with considerable trepidation that he had accepted the Council's gracious invitation to speak on "lessons" of the Korean campaign, mainly for two reasons. Firstly, while his youth and inexperience meant that he had learnt many lessons, the lessons would probably not be new to those with several years of experience in previous wars. Secondly, as Ibsen had averred, "an ordinary thinker sees all separately and not the whole completely", and the regimental medical officer to a lone Australian battalion in a Commonwealth brigade forming a small part of a recently constituted United Nations force could scarcely see "the whole completely".

Dr. Gandevia attributed to his too idealistic youth his inability to view his first lesson with equanimity. That lesson was the realization, chiefly on his return, of the apathy and indifference of the Australian people to the war in Korea. Paradoxically enough, they seemed to have taken to their hearts the philosophy of a Persian, preferring to

Take the Cash, and let the Credit go,
Nor heed the rumble of a distant Drum.

Recently he had been asked whether the Australians had ever suffered any casualties "to speak of" in Korea.

With the aid of photographic slides, Dr. Gandevia proceeded to consider some of the problems presented by the nature of the warfare, the climate and the terrain. He discussed the advisability of modifying stretcher jeeps and the large ambulances, to minimize the exposure of wounded personnel to cold. He said that during the highly mobile period of the campaign (September to November, 1950) it had been necessary to transport a self-supporting regimental aid post, with staff, tent and stores for twenty-four to forty-eight hours, on the stretcher jeep; that involved unloading and inevitable delay if the jeep was suddenly required further forward for the evacuation of casualties.

Dr. Gandevia indicated some of the lessons to be learnt from the exposure of troops to a winter of a severity which they had not foreseen and to which they were unaccustomed. The training of the individual in methods of prophylaxis was shown to be of paramount importance in the prevention of frostbite. Some means had yet to be devised of distinguishing between cases of early frostbite in which recovery would occur with the simple methods of treatment available in the unit area, and cases outwardly similar in all respects but in which a long period of hospital treatment would be required. Until such differentiation could be effected, all patients must be evacuated immediately, with consequent wastage of front-line manpower. In the regimental aid post routine treatment, when the patient was not evacuated immediately because of the military situation, consisted of massage with oily brushless shaving cream, which had the advantage of remaining semifluid at low temperatures. It appeared to do no harm. Men aged over thirty-five years did not stand up to the cold well, presenting as a rule with pain of a disabling nature in joints, back or muscles. The cold produced pain in recent wounds and old injuries, particularly injuries to the spine or limbs. Those complaints, although not always associated with physical signs, were unquestionably genuine. Chronic or latent foci

of infection were often activated, the commonest example encountered being a "flare-up" of chronic prostatitis.

Dr. Gandevia emphasized the value of training every individual to carry out all routine hygiene precautions with the utmost care and thoroughness. He said that that was vital in Korea, which had been described as "a faecal country covered by dust in the summer and snow in the winter", where almost every disease in the text-books was to be found. Adequate understanding by all ranks of the principles involved was fundamental, and therefore junior officers in particular should possess a reasonable knowledge of preventive medicine. The disposal of excreta and water discipline were matters requiring constant supervision.

In conclusion, Dr. Gandevia quoted Sir Thomas Browne's statement in his "Religio Medici": "Where I cannot satisfy my Reason I love to humour my fancy." He said that the latter alternative had coloured too many statements in the Press concerning Korea, and while he had little to contribute other than his personal experience, he had attempted to minimize any similar tendency.

DR. E. S. R. HUGHES said that a number of cases of frostbite had been encountered during mid-winter. His experience was limited to about 50 cases, but in one American hospital near Tokyo there were two or three thousand cases, whilst the frostbite casualty rate in the North Korean and Chinese forces was extremely high. Certain clinical types were noted: (i) Some patients complained of numbness of the toes; nothing could be found on examination except hypoaesthesia or anaesthesia. A patient would throw off his slipper and kick the iron bed to prove his complaint. (ii) Some had slight erythema of the skin, frequently accompanied by local hyperhidrosis. (iii) In the third group, blisters, often black in colour, appeared on one or more toes. (iv) In more severe cases there was a patch of dry gangrene involving the whole skin thickness, usually on the great toe. (v) Lastly, they occasionally encountered cases in which it looked as though the foot had been immersed in black ink; despite that forbidding appearance, the patient usually possessed relatively good movements of the affected parts. The factors responsible for the changes were not clear. Certainly there had to be subzero temperatures, and moist feet were more likely to be affected than dry. Dr. Hughes said that he did not feel competent to separate the true frostbite foot from immersion foot, but the problems of treatment seemed the same in both. Whatever the type, the surgeon was reluctant to interfere in any way. In the first two groups, the patients had been treated with bed rest and foot hygiene, and after a few weeks had been discharged to a holding unit. In the last two groups, they had adopted the conservative policy observed by British and United States surgeons; early surgery certainly appeared to be unsatisfactory. The patients were evacuated home as soon as possible. The problem of correct disposal of the third group of patients was difficult; the lesion seemed hardly severe enough to warrant evacuation, but return to the front lines was frequently followed by relapse. Sympathectomy had not given satisfactory results. Dr. Hughes commented that some seasoned British regular troops who had suffered frostbite in earlier campaigns had not been able to stand up to the cold in Korea; pain restricted every movement. He mentioned, while on the subject of the effects of cold temperatures, that a number of men had been sent back to the base hospital with incapacitating pain in old wounds due to cold temperatures, and remarked that when he was at Oxford, some observations had been made with Kellgren which illustrated the adverse effects of cold temperatures in aggravating the spontaneous pain associated with neuromata.

Dr. Hughes went on to say that the open wound had provided the largest number of cases in the campaign. Rather more than half of those wounds had been complicated (193 of 353 wounds). Once the open wound had been converted into a closed wound, the treatment of the complication was simplified. Most vascular injuries required treatment at the same time as the open wound. In cases of the nerve injuries the state of the nerve was noted and recorded, but no attempt was made to repair it. Fractured bones were manipulated into the best possible position, but no form of internal fixation was used at that stage.

Most of the wounds were either penetrating or through-and-through; a smaller number were large and ragged. All wounds had received preliminary treatment at forward units, and all patients had been started on a course of penicillin. Plaster-of-Paris casts of high quality has been applied.

All plasters were removed in the theatre, with the patient prepared for general anaesthesia. They used a large theatre, which held two operating tables. The Stryker plaster cutter.

which was used by United States units, would have been of considerable assistance in removing plasters, some of which were half to three-quarters of an inch thick. Windows cut in the original plaster were not satisfactory; there was a chance that an unrecorded wound was present.

Most of the wounds looked excellent, a tribute to good forward surgery, adequate and continuous immobilization and chemotherapy. Some wounds, especially those of the feet and to a lesser extent the hands, had a most unpleasant smell, but after excision of the slough the wound looked satisfactory, and they subsequently did well. Some had a surrounding ring of induration and reddened skin. Even those wounds could be closed. A few wounds were severely infected with puffy oedema spreading far beyond the wound. Those were the wounds that had received inadequate surgery, had been poorly immobilized and maybe had missed any regular chemotherapy *en route*. Culture of a few wounds was carried out, but the bacteriological findings were not of much assistance in treatment.

The wound was excised in the orthodox way. If conditions were favourable, they proceeded to close the wound. If the wound was infected, or if the efficiency of the excision was uncertain, the open wound was dressed with an absorbent dressing and immobilized in plaster. Three or four days later the wound was reinspected, and if it was satisfactory, closure followed. That multiple-stage closure plan was excellent, and they had no hesitation in excising an infected wound two or three times before closing it.

Through-and-through wounds, if very small and obviously due to a small missile, usually required no treatment. If the entrance and exit wounds were large and close together, the track was laid open, excised and sutured immediately or a few days later. If the skin wounds were far apart, they were excised and treated separately. Most penetrating wounds were explored and excised; they were sutured at the time or some days later. Some of the deep wounds were drained for a few hours to try to avoid the formation of a hæmatoma; in most cases hæmostasis was secured, either at operation or by the post-operative use of a pressure bandage. Drainage tubes frequently proved inefficient.

The large ragged wounds were always interesting. No effort was made to suture them. If the floor of the wound was muscle or tissue that would take a split-skin graft, that was applied, usually in large sheets. If vital structures were in the floor of the wound, for example, nerves and vessels, joint and bones, a full-thickness flap was swung over the wound and the secondary defect grafted. Although most of the wounds were sutured, the proportion of grafted wounds rose later in the series. That might have been due to more severe wounds, but they were impressed by the results of grafting.

After wound closure, wounds were inspected within the first two or three days after suture and on the fourth or fifth day after skin grafting. Removal of a suture, wiping away of blood clot *et cetera* might well make the difference between uncomplicated healing and wound infection. Penicillin was administered routinely and combined with streptomycin in about half the cases. Streptomycin did not influence greatly the numbers of wounds healed in ten days. The United States surgeons had access to a much wider field of antibiotic drugs, but their results were similar to the Australian; that was due to the overlap of influence of the individual drugs.

The results were good. There were three failures in delayed primary sutures; by failure Dr. Hughes meant that the wound was not improved by the suture. Twenty wounds so treated were complicated by sepsis; but that did not represent a failure; skin cover was the aim, and that was achieved in the shortest possible time. The same applied to skin grafting. The results of flaps were disappointing so far as statistics were concerned. But their place in the treatment of the open wound was quite definite. There was certainly nothing in the results to justify a return to methods designed to secure healing by secondary intention.

In conclusion, Dr. Hughes pointed out that the results were no better than those obtained by Australian surgeons in World War II, and he acknowledged the clear teaching of such surgeons as Dr. C. W. B. Littlejohn and Dr. B. K. Rank, who were present at the meeting.

MAJOR-GENERAL F. K. NORRIS pointed out that there were many misconceptions about Korea. It was a horrible country in which to wage war. He felt that it was not generally recognized that less than 1% of war wounded had died—that was a fantastic figure. One of the problems was the filth present in Korea and the sickness rate of the huge numbers of prisoners held by the Allies. He had seen a whole

annexe full of prisoners in convulsions with tetanus, and another where every patient had malignant confluent smallpox. Among the Australian troops there had been no definite case of malaria, and of all the sick men who had been evacuated only one had died—and he of acute diabetes. General Norris felt that that was an astonishing record. He then went on to show some slides, including pictures of helicopter evacuation. He suggested that that was a great advance in evacuation of casualties. Finally he thanked both speakers for their papers and said that he thought the lessons taught by them would be of great value.

BRIGADIER C. W. NYE gave a brief résumé of the history of the Australian troops in the Korean war. He described the increase in the hospital facilities and stated that the medical set-up was now practically complete.

DR. C. W. B. LITTLEJOHN said that he had enjoyed both papers very much. He asked for more details of the methods used for the prevention and treatment of frostbite.

In reply, Captain Gandevia said that shaving cream was used as a prophylactic measure and for treatment in mild cases of frostbite. An American pamphlet that he had seen suggested whale oil. Other preventive measures were detailed in instruction to troops on the care of feet, socks and shoes.

Out of the Past.

In this column will be published from time to time extracts, taken from medical journals, newspapers, official and historical records, diaries and so on, dealing with events connected with the early medical history of Australia.

REPORT OF A MEDICAL BOARD ON AN EPIDEMIC OF SCARLATINA.¹

[Government Gazette, May 14, 1841.]

Sir,

We have the honour to acknowledge the receipt of your communication of the 6th inst. conveying the request of His Excellency the Governor "that he might be furnished with any information which the Medical Board might possess, as to the prevalence of sickness at the present time in the town of Sydney, and also as to whether the board considered that anything might be done by the Government for its alleviation".

In directing our consideration to the important subject of His Excellency's communication, we beg most respectfully to state, that as the duties of the Medical Board are confined solely to the examination and registration of the testimonials of qualification of parties desirous of being enrolled as legally qualified Medical Practitioners, the matter referred to by His Excellency, has never come before us as a Medical Board; but, as some of the members in their individual capacity, have had an opportunity of becoming conversant with the general state of health of the inhabitants of the town of Sydney, we do ourselves the honour of submitting for the information of His Excellency, the following brief and necessarily hurried observations in regard to it.

1st. It is undeniable that an unusual amount both of sickness and mortality has for some time past prevailed, and still exists in the town of Sydney.

2ndly. That the condition above referred to as affecting the state of health of the inhabitants of Sydney in a great measure depends upon the existence of "Scarlatina" or "Scarlet Fever", a disease of a specific and contagious character, usually manifesting itself only once in the lifetime of an individual, and which, from its never having previously appeared in the Colony, must, we apprehend, owe its origin to some exterior source.

3rdly. That the existence of this disease was first brought under our notice (and we believe made its first appearance in the Colony) about the commencement of the present year—that at the period above mentioned it was almost exclusively confined to the north western parts of the town of Sydney, but that it has since extended itself in every direction, and is now, we believe, prevailing in many parts of the country.

¹ From the original in the Mitchell Library, Sydney.

4thly. That the extreme prevalence of the disease in this Colony, may, in a great measure, be accounted for, by the circumstance that a large proportion of its inhabitants has for the first time been exposed to its influence: and the probable increase on the average mortality arising from the same disease, as observed in Europe, may be explained by reference to the generally acknowledged law, governing the diffusion of contagious disorders, viz—that they are always more fatal on their first introduction to Countries, where their influence has never previously been experienced.

5thly. In allusion to that part of His Excellency's communication which refers to the steps which the Government might possibly take for the removal, or alleviation of the prevailing sickness, we regret to say, that we consider no measures which the Government could adopt would have any decided influence on the progress of the disease. As it is generally believed, however, that most diseases of a contagious character are apt to assume a more or less malignant aspect, according to circumstances, which have a general influence of the health of the community, such as due supply of water, an effectual drainage, the removing of all decaying or refuse animal and vegetable matter, and the avoidance of too great a concentration of the population in crowded and close lanes and alleys: we would most respectfully suggest, that it can only be by the establishment of some municipal or legislative enactments, whereby the Police of the town might, in such particulars, be regulated, that the health of the inhabitants can hereafter be influenced, and the progress of any future epidemic, or contagious disorder either mitigated or arrested.

Other causes, frequently assigned as tending to produce or aggravate epidemic or contagious diseases in Europe, and as creating a more than usual susceptibility to their influence, viz—those arising from poverty, insufficient or unwholesome food, insufficient clothing or unhealthy occupation, we believe can have had no influence whatever on the disease now prevalent. The lower ranks of the inhabitants of Sydney seem by no means to have been affected in a greater degree, or in undue proportion by the prevailing disorder, over the other classes of the community: a circumstance arising, in all probability, from the high rate of remuneration for labour, the sufficiency and reasonable price of food and their ability to command a large share of the comforts and necessities of life.

In concluding these necessarily brief and imperfect remarks upon the subject of His Excellency's Communication, we would take the liberty of adding our conviction of the paramount importance of a strict enforcement of all Quarantine regulations. We are led to offer this observation, more particularly from the circumstances of our having learnt recently that "smallpox" is prevailing to a great extent at the Mauritius, with which island this colony is in frequent communication: coupled with the fact that at the present time there are no means of affording the inhabitants of the Colony the protecting advantages of vaccination: and, we need not add, that the introduction of the smallpox, under the circumstances here pointed out, would be much more serious in its consequences, and in all probability attended by a much larger amount of mortality, than that which has accompanied the existing, or any previous disease.

We are, Sir,

Your most obedient servants,

J. V. THOMPSON,
Deputy Inspector General.
CHAS. NICHOLSON, M.D.
F. L. WALLACE, M.D.

To the Honorable the Colonial Secretary.

Correspondence.

A DISCLAIMER.

SIR: In your issue of November 3, 1951, page 597, you published an article entitled "A Virus Isolated from a Case Resembling Epidemic Pleurodynia: A Preliminary Report" by Mr. D. W. Howes, purporting to come from the Department of Bacteriology, University of Adelaide. Mr. Howes submitted this article to you without either my knowledge or consent, and I hereby disclaim any personal or departmental connexion with it. Work on this virus carried out in the Department of Bacteriology, University of Adelaide,

has been recorded by Atkinson, Dineen and Robertson in *The Australian Journal of Experimental Biology and Medical Science*, Volume XXIX, page 463, 1951.

Yours, etc.,

NANCY ATKINSON,
Reader-in-Charge, Department of
Bacteriology.

University of Adelaide,
Adelaide,
February 12, 1952.

POLICE OFFENCES (AMENDMENT) ACT, 1908 (NEW SOUTH WALES), AS AMENDED.

SIR: I desire to inform you that the Drug Regulations under the *Police Offences (Amendment) Act* have been amended to enable persons dispensing prescriptions to deal with prescriptions issued under the National Health (Medicines for Pensioners) Regulations or on behalf of the Commonwealth Repatriation Commission in the same manner as any prescription issued under the *Pharmaceutical Benefits Act*, that is, to cancel and retain the duplicate of such prescriptions in lieu of the original.

A copy of the amendment, which is being published in the issue of the *Government Gazette* today, is attached for your information.

It would be appreciated if the amendment could be publicized in your journal.

Yours, etc.,
C. J. BUTTSWORTH,
Under Secretary.

Chief Secretary's Department,
Sydney,
February 15, 1952.

His Excellency the Governor, with the advice of the Executive Council, has been pleased to amend in the manner set forth hereunder, the Regulations under the *Police Offences (Amendment) Act*, 1908, as amended.

CLIVE EVATT.

Regulation 19 is amended by inserting in the proviso to sub-paragraph (b) of paragraph (3) after the words "Parliament of the Commonwealth of Australia" the following words: "or the National Health (Medicines for Pensioners) Regulations under the National Health Service Act, 1948-1949, of the said Parliament, or in respect of any prescription issued on behalf of the Repatriation Commission of the Commonwealth of Australia."

NASAL SINUSITIS.

SIR: The following story is a not-very uncommon one of misunderstanding and of a patient being misled and subjected to a lot of unnecessary treatment. All this was, of course, in perfect good faith, although the wisdom of some of the statements is not beyond question.

The patient is a rather overgrown girl of eleven years and comes from the country. She is in residence at a boarding school in the city and suffers from recurring colds with a running nose and a dry cough. She has never at any time had abundant sputum and has enjoyed many intervals during which she was quite well. In August last year she had an attack of this nature and was seen by a general practitioner, who had her chest and her nasal sinuses X-rayed by a very experienced radiologist. He reported dulness of her antra and of one frontal sinus. He also reported an increase of the bronchial markings and said: "Suggests bronchiectasis."

On the strength of this report the practitioner wrote to the mother as follows: "She has advanced infection in the sinuses of her nose, and also advanced chronic bronchitis and bronchiectasis of the left lung." While I do not call into question his good faith in this action, it is a serious reflection on his good sense and his clinical acumen. To diagnose "advanced infection of the sinuses of her nose" on such slight evidence is foolish, not to say inaccurate. The child suffers from recurrent nasal infection based on an allergy. It is quite wrong to call it advanced. The diagnosis of bronchiectasis in the absence of sputum has very little justification. I am sure the radiologist had no intention beyond that of suggesting that it was a thing to bear

in mind and to look for. With no corresponding signs and no suggestive symptoms I am certain no experienced specialist would intend this report to be taken as a diagnosis.

The use of X rays for the diagnosis of sinus disease is of great value. It can be most misleading, too, if the reports are taken verbally by the less experienced and without knowledge of what is going on. A dull antrum may be quite clear in a couple of hours in an allergic subject. The picture seen is that of the moment. True, in some chronic cases there are bony changes recognizable. This is not the rule, however, and the appearances of radiopacity have to be interpreted skilfully. It is not possible to differentiate by X rays a recurrence either from a simple acute sinusitis or, in most cases, from a chronic one. The report of dullness should lead to further investigation to arrive at the diagnosis. Certain it is that X rays cannot decide if there are complicating factors like allergy, although this is the underlying and determining foundation for so many recurrent attacks of sinusitis.

The practitioner then went on to say: "I suggest that she do one of two things: (a) See an ear, nose and throat specialist. I frankly do not think that course is very satisfactory. (b) I will treat her during next term with short-wave electrical treatment and penicillin inhalation."

I would point out here that the practitioner, however honest his motives, is giving advice without having made an accurate diagnosis. He is also advising his patient to refrain from seeking competent advice, which would at the best confirm him in his opinion. Is this because he disbelieves that an ear, nose and throat specialist will know as much as he about his patient's illness and the best treatment for it, or is it because he feels sure that the well-informed specialist will condemn the course he wants to give because his knowledge and experience tell him it is useless? I believe the second answer is the true one.

As one with more than twenty-five years' experience of sinus disease I affirm quite clearly that short-wave therapy is very little use in treating sinus disease. It is true some patients may recover while having it, but their course is little influenced by the therapy. Indeed it will not be helpful at all unless the other necessary treatment is administered.

Regarding penicillin inhalation as the treatment of "advanced chronic bronchitis and bronchiectasis", I leave further comment to the physicians. It is sufficient for the present to say that the child has been seen by a leading medical consultant, who does not agree that she has bronchiectasis; and for her sinuses, now that she has seen an ear, nose and throat specialist, she will have what she requires, namely, a simple antrostomy. This will not only assist the present attack to subside, but will also provide relief in any recurrent attacks that may arise later.

It has been my experience, sir, to come across a chain of circumstances rather like this one on several occasions, but this is the first time I have had the privilege of reading the advice given in writing. It seems to be to me a good opportunity to ask you to publish the story as a warning.

Yours, etc.,
ERIC P. BLASHKI.

193 Macquarie Street,
Sydney,
February 13, 1952.

Congresses.

COMMONWEALTH AND EMPIRE HEALTH AND TUBERCULOSIS CONFERENCE.

THE Commonwealth and Empire Health and Tuberculosis Conference arranged by the National Association for the Prevention of Tuberculosis will be held in London from July 8 to 13, 1952. The conference is open to all interested in preventive medicine, including the medical and veterinary professions, commercial and industrial executives, nurses, social workers, health administrators, members of public authorities and regional hospital boards.

Subjects for discussion include protective vaccination, contemporary ideas in the management of the tuberculous patient, the social worker and the tuberculous family, the patient in industry and tuberculosis in British colonial territories. A new feature of the conference will be special smaller gatherings for those with particular interests, whether doctors, nurses, public health officials or social workers, at which appropriate subjects will be discussed.

Receptions for delegates are being held at many well-known institutions, and a large number of visits to hospitals and sanatoria have been arranged in addition to tours of general interest.

All information can be obtained from the NAPT, Tavistock House North, Tavistock Square, London, W.C.1.

TUBERCULOSIS AND DISEASES OF THE CHEST.

THE twelfth conference of the International Union Against Tuberculosis will be held at Rio de Janeiro, under the presidency of Professor Manoel de Abreu, on August 24-27, 1952. The following subjects will be discussed: "Immunity and Tuberculosis", opening report by Professor Arvid Wallgren (Sweden); "Treatment and Prognosis in Minimal Pulmonary Tuberculosis", opening report by Dr. J. Burns Amberson (United States of America); "Organization and Results in Regard to the Tuberculosis Campaign of Mass Surveys", opening report by Dr. Fernando Gomez (Uruguay). The co-reporters will be designated later.

Members of the Union may take part in the conference without paying an admission fee. Physicians who do not belong to the Union may apply for "membership of the conference" and should send in their applications exclusively through their Government or national association, who are alone qualified to forward such applications.

All requests for information concerning the scientific discussions should be sent to Professor Etienne Bernard, Secretary-General of the International Union Against Tuberculosis, 66 Boulevard St.-Michel, Paris. All requests concerning the organization of the conference should be sent to the secretariat of the conference, Avenida Mem de Sá, 197, Rio de Janeiro.

The conference will be followed by the eleventh International Congress of the American College of Chest Physicians, under the presidency of Professor Manoel de Abreu, to be held at Rio de Janeiro on August 28-30, 1952.

Further information can be obtained from the office of THE MEDICAL JOURNAL OF AUSTRALIA.

Post-Graduate Work.

THE POST-GRADUATE COMMITTEE IN MEDICINE IN THE UNIVERSITY OF SYDNEY.

Clinical Meeting at Balmoral Naval Hospital.

THE Post-Graduate Committee in Medicine in the University of Sydney announces that a clinical meeting will be held at the Balmoral Naval Hospital on Tuesday, March 18, 1952, at 2 p.m., when Dr. Alan Sharp will speak on "Surgical Aspects on Thrombosis and Ischemia". Clinical cases will be shown at 4 p.m., after afternoon tea. All members of the medical profession are cordially invited to attend.

Australian Medical Board Proceedings.

NEW SOUTH WALES.

THE following have been registered, pursuant to the provisions of the *Medical Practitioners Act*, 1938-1950, as duly qualified medical practitioners: Dawkins, Donald Campbell, M.B., B.S., 1939 (Univ. Adelaide); Joyce, Patrick Raymond, M.B., B.Ch., 1946 (National University, Ireland); Manton, Harry Jervis, M.B., B.S., 1951 (Univ. Melbourne); Nowell, Thomas Algernon, M.B., Ch.B., 1944 (Victoria University, Manchester); Philp, Robert Alexander, M.B., Ch.B., 1939 (Univ. St. Andrews); Jones, Gwyn Francis, M.R.C.S., L.R.C.P. (London), 1933, M.B., B.S., 1934 (Univ. London); Macfie, Hugh Blyth Alexander, M.B., Ch.B., 1936 (Univ. Edinburgh), D.T.M. and H. (Edinburgh), 1940; Mulholland, Gerald Vincent, M.R.C.S. (England), L.R.C.P. (London), 1949; Stewart, Alastair Keith McKellar, M.B., B.S., 1951 (Univ. Adelaide); Ament, Leon, registered in accordance with the provisions of Section 17 (1) (c); Brauner, Adolph,

registered in accordance with the provisions of Section 17 (1) (c); Frank, Derek David, registered in accordance with the provisions of Section 17 (1) (c); Frant, Henryk, registered in accordance with the provisions of Section 17 (1) (c); Hellreich, Bernhard, registered in accordance with the provisions of Section 17 (1) (c); Herscovici, Moses Moise, registered in accordance with the provisions of Section 17 (1) (c); Klajnewajg, Zygmunt, registered in accordance with the provisions of Section 17 (1) (c); Listwan, Ignacy Andrew, registered in accordance with the provisions of Section 17 (1) (c); Nowak, Jan Teodor, registered in accordance with the provisions of Section 17 (1) (c); Orban, Alice, registered in accordance with the provisions of Section 17 (1) (c); Pollak, Alexander, registered in accordance with the provisions of Section 17 (1) (c); Reiner, Zenon, registered in accordance with the provisions of Section 17 (1) (c); Rosleigh, Ronald Francis, registered in accordance with the provisions of Section 17 (1) (c); Sanecki, Joseph Maciej, registered in accordance with the provisions of Section 17 (1) (c); Turek, Moses, registered in accordance with the provisions of Section 17 (1) (c); Welsz, Andrew, registered in accordance with the provisions of Section 17 (1) (c).

The following additional qualifications have been registered: Bond, John Anthony (M.B., 1939, B.S., 1945, Univ. Sydney), M.S., 1951 (Univ. Sydney); Chapman, Patricia Joan (M.B., B.S., 1947, Univ. Sydney), D.C.H. (R.C.P. and S., England), 1950; Fraser, Malcolm Britnell (M.B., Ch.M., 1921, M.S., 1935, Univ. Sydney), F.R.C.O.G., 1951; Grant, Alan Mostyn Bradford (M.B., B.S., 1929, Univ. Sydney, F.R.C.S., Edinburgh, 1935), M.R.C.O.G., 1951; Grattan-Smith, Maureen (M.B., B.S., 1943, Univ. Sydney), D.P.H. (Univ. Sydney), 1951; O'Donnell, Thomas Henry (M.B., B.S., 1942, Univ. Sydney), D.L.O. (Univ. Sydney), 1951; Rich, David Louis (M.B., B.S., 1945, Univ. Sydney), Dip.Ophth. (Univ. Sydney), 1951; Walter, Clement Jack (M.B., B.S., 1947, Univ. Sydney), Dip.Ophth. (Univ. Sydney), 1951; Wilson, James Keith (M.B., B.S., 1943, Univ. Sydney), D.P.M. (Univ. Sydney), 1951; Davis, Neville Coleman (M.B., B.S., 1945, Univ. Sydney), F.R.C.S. (England), 1950; Greenberg, Harris Phillip (M.B., B.S., 1944, Univ. Sydney), D.P.M., 1951 (Univ. Sydney); Radeski, Carl (M.B., B.S., 1944, Univ. Sydney), D.P.M., 1951 (Univ. Sydney); Stevenson, Robert Baynton Comrie (M.B., Ch.M., 1924, Univ. Sydney), M.R.C.O.G., 1949.

QUEENSLAND.

The following have been registered, pursuant to the provisions of *The Medical Acts, 1939-1948*, as duly qualified medical practitioners: Stoll, Jack Alexander, M.B., Ch.B., 1946 (Univ. Glasgow), Section 19 (1) (b)); Ogden, John Kenworthy, M.R.C.S. (England), 1943, L.R.C.P. (London), 1943, D.Obst., R.C.O.G. (London), 1946.

The following additional qualifications have been registered: Tod, Peter Alexander, D.R. (Univ. Sydney), 1947; Woolcock, William John Patrick, M.R.A.C.P., 1946.

TASMANIA.

The following have been registered, pursuant to the provisions of the *Medical Act, 1918*, as duly qualified medical practitioners: Taylor, John N., M.B., B.S., 1951 (Univ. Melbourne); Stubley, Alan John, M.B., B.S., 1951 (Univ. Melbourne); Gilseman, Leon Desmond, M.B., B.S., 1950 (Univ. Melbourne); Miller, Kenneth John, M.B., B.S., 1949 (Univ. Melbourne); Lancaster, Norman Edgar, M.B., B.S., 1950 (Univ. Sydney); O'Reilly, James Kevin, M.B., B.S., 1943 (Univ. Melbourne); Grant, Rodney Edwards, M.B., B.S., 1950 (Univ. Queensland).

Notice.

AUSTRALIAN RED CROSS SOCIETY.

A SCIENTIFIC MEETING arranged by the Australian Red Cross Society will be held in the Robert H. Todd Assembly Hall, British Medical Association House, 135 Macquarie Street, Sydney, on March 6, 1952, at 8.15 p.m. The programme is as follows: "Pathogenesis of the Renal Lesion

DISEASES NOTIFIED IN EACH STATE AND TERRITORY OF AUSTRALIA FOR THE WEEK ENDED FEBRUARY 2, 1952.¹

Disease.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	Northern Territory.	Australian Capital Territory.	Australia.
Acute Rheumatism
Amoebiasis
Ancylostomiasis	2(1)	..	..	..	..	..	2
Anthrax
Bilharziasis
Brucellosis	1	..	..	1(1)	..	..	..	..	2
Cholera
Chorea (St. Vitus)
Dengue
Diarrhoea (Infantile)	1(1)	..	1	..	1	..	3
Diphtheria	1	3(3)	4(3)	..	4(4)	..	..	..	12
Dysentery (Bacillary)	5(5)	..	..	..	..	..	..	5
Encephalitis	4(2)	..	..	..	..	..	..	4
Filariasis
Homologous Serum Jaundice
Hydatid
Infective Hepatitis	7(4)	..	..	..	7
Lead Poisoning
Leprosy
Leptospirosis	2	..	..	..	..	..	2
Malaria
Meningococcal Infection	3(3)	3(3)	..	..	2	..	..	..	8
Ophthalmia
Ornithosis
Paratyphoid	1(1)	..	..	..	..	1
Plague
Polio-myelitis	6(2)	3(1)	9(5)	13(7)	1	..	..	..	32
Puerperal Fever
Rubella	8(6)	..	..	1(1)	..	..	..	9
Salmonella Infection
Scarlet Fever	9(6)	5(1)	3(1)	2(2)	2(2)	..	..	..	21
Smallpox
Tetanus
Trachoma
Trichinosis
Tuberculosis	37(29)	13(11)	17(9)	1(1)	8(4)	5(3)	1	2	84
Typhoid Fever	2(1)	..	..	..	..	..	..	2
Typhus (Flea, Mite- and Tick-borne)	1(1)	..	3(1)	..	1(1)	..	..	..	5
Typhus (Louse-borne)
Yellow Fever

¹ Figures in parentheses are those for the metropolitan area.

following Intravascular Hemolysis", Dr. C. R. Bickerton Blackburn (Sydney); "A New Human Blood Group and its Significance", Dr. R. J. Walsh (Sydney) and Miss O. Kooptzoff (Sydney); "A Method for Measuring the Hematocrit Value of Capillary Blood", Dr. I. Kaldor (Sydney); "The Preparation and Use of Concentrated Red Cells", Dr. R. J. Walsh (Sydney). A cordial invitation is extended to all those interested.

ROYAL PRINCE ALFRED HOSPITAL THORACIC UNIT.

THERE will be a clinico-pathological meeting of the thoracic unit of the Royal Prince Alfred Hospital on Friday, March 7, 1952, at 7.30 p.m. in the Robert Scot Skirving (A2) Lecture Theatre. All who may be interested are invited to be present.

Obituary.

GEORGE FREDERICK HEWER.

We regret to announce the death of Dr. George Frederick Hewer, which occurred on February 16, 1952, at Sydney.

HAROLD VERNON FOXTON.

We regret to announce the death of Dr. Harold Vernon Foxton, which occurred on February 14, 1952, at Indooroopilly, Queensland.

NORMAN WILLIAM HANSARD.

We regret to announce the death of Dr. Norman William Hansard, which occurred on February 19, 1952, at Jervis Bay, New South Wales.

Medical Appointments.

Dr. C. Craig and Dr. John Edis have been appointed members of the Cancer Institute Board of Tasmania, pursuant to the provisions of Section 5 (1) (c) of the *Cancer Institute Act, 1948* (No. 5341).

Dr. F. G. Fenton and Dr. Thomas a'B. Travers have been appointed members of the Opticians' Registration Board of Victoria.

Dr. E. L. Roberts has been appointed medical superintendent of the Mental Hospital, Ararat, Victoria.

Dr. H. J. C. Edmonds has been appointed medical superintendent of the Mental Hospital and Receiving House, Ballarat, Victoria.

Dr. J. M. O. Wilson has been appointed a public vaccinator for the city of Coburg, Victoria.

Dr. J. J. Searby, Dr. F. J. Kenny and Dr. M. H. Slonim have been appointed public vaccinators for the Shire of Warrnambool, Victoria.

Dr. W. E. L. Crowther has been appointed president of the Medical Council of Tasmania.

Dr. P. B. Robin has been appointed government medical officer at Chinchilla, Queensland.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Harris, Henry Thomas Wilfrid, M.B., 1951 (Univ. Sydney), Box 64, P.O., Broken Hill.

Harrell, Francis Charles, M.B., B.S., 1951 (Univ. Sydney), Royal North Shore Hospital of Sydney, Crow's Nest.

Kosman, Edward, M.B., B.S., 1951 (Univ. Sydney), 24 Wentworth Avenue, Mascot.

Orban, Alice, registered in accordance with the *Medical Practitioners Act, 1938-1951*, Section 17 (1) (c), 148 Hewlett Street, Waverley.

Diary for the Month.

- MARCH 4.—New South Wales Branch, B.M.A.: Executive and Finance Committee; Organization and Science Committee.
 MARCH 5.—Victorian Branch, B.M.A.: Branch Meeting.
 MARCH 5.—Western Australian Branch, B.M.A.: Council Meeting.
 MARCH 6.—South Australian Branch, B.M.A.: Council Meeting.
 MARCH 7.—Queensland Branch, B.M.A.: Branch Meeting.
 MARCH 11.—New South Wales Branch, B.M.A.: Medical Politics Committee.
 MARCH 11.—New South Wales Branch, B.M.A.: Ethics Committee.
 MARCH 14.—Queensland Branch, B.M.A.: Council Meeting.
 MARCH 17.—Victorian Branch, B.M.A.: Finance Subcommittee.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Medical Secretary, 135 Macquarie Street, Sydney): All contract practice appointments in New South Wales.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federal Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225 Wickham Terrace, Brisbane, B17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178 North Terrace, Adelaide): All Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205 Saint George's Terrace, Perth): Norseman Hospital; all Contract Practice appointments in Western Australia. All government appointments with the exception of those of the Department of Public Health.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

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